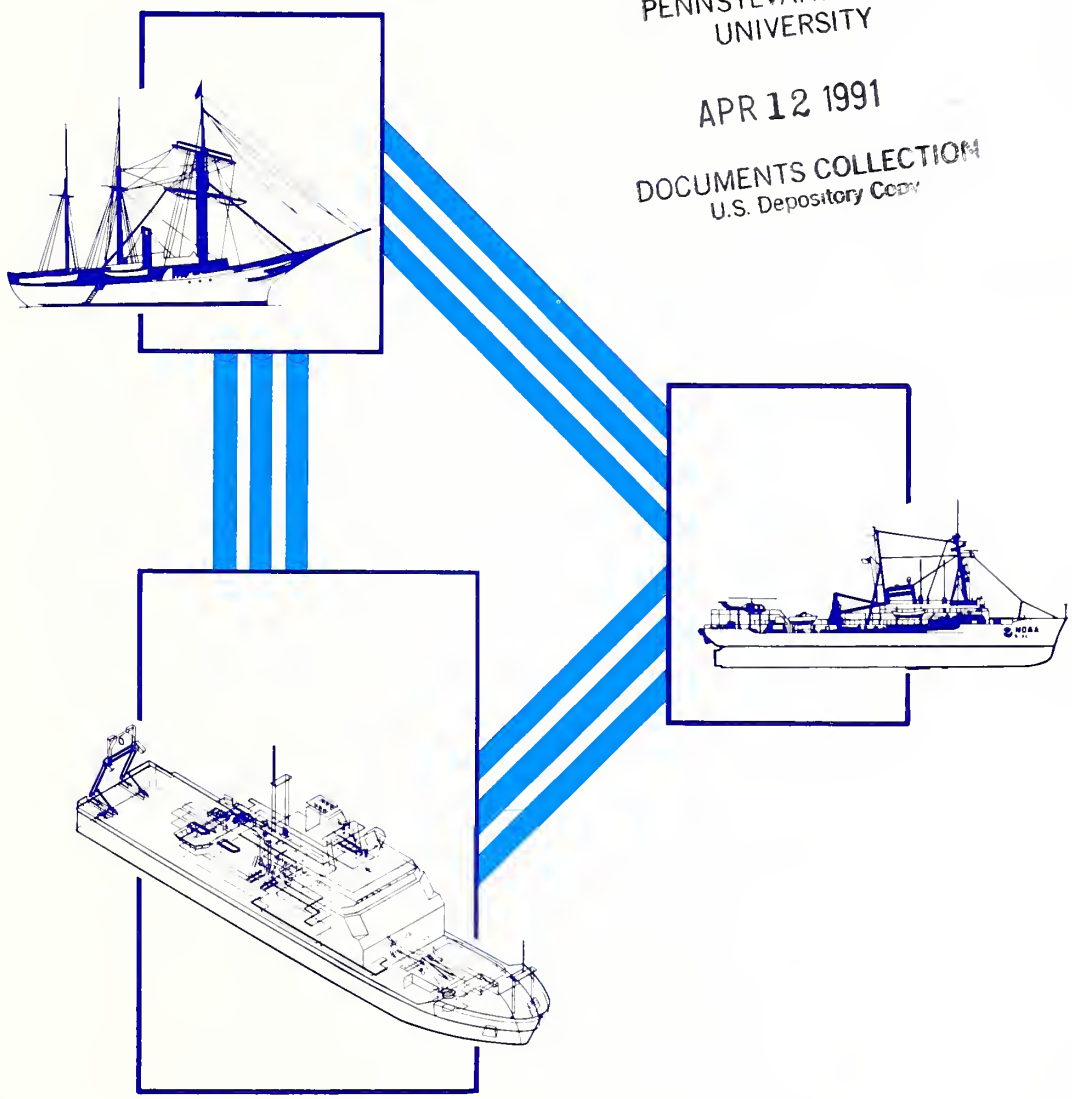
NOAA'S OCEAN FLEET MODERNIZATION STUDY

Phase 3: Long-Term Strategy



U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
Office of the Chief Scientist

NOAA OCEAN FLEET: YESTERDAY, TODAY, TOMORROW

NOAA was created in 1970 through a Presidential reorganization, but the survey activities of the fleet of one of its predecessor agencies, the U.S. Coast and Geodetic Survey, became well established in the nineteenth century. Sketched from a photo is perhaps the best-known survey vessel of its time, the PATTERSON, built by James D. Leary at Brooklyn, NY, in 1883. It was a wood auxiliary barkentine, 435 tons, 163 feet long, with a 27 foot beam, and a draft of 14 feet. Much of its survey work was done in Alaskan waters.

Commissioned in April 1960, the SURVEYOR, here depicted in a drawing, is a part of NOAA's current ocean fleet. The ship has a welded steel/ice-strengthened hull and is 2,653 gross tons, 292 feet long, with a 46-foot breadth and a draft of 19.5 feet. It was built by the National Steel and Shipbuilding Company of San Diego, CA. The SURVEYOR conducts worldwide oceanographic research but is nearing the end of its useful service life (see p.2).

A modernized NOAA fleet might employ ship designs such as the one shown for the JAMES CLARK ROSS which will soon join the fleet of the British Antarctica Survey. This ship is ice-strengthened. It is being built at the Swan Hunter Shipyard at Newcastle, England, and will be commissioned early in 1991.

(Photo of the PATTERSON and drawing of the SURVEYOR courtesy of NOAA/Office of NOAA Corps Operations. Sketch of the JAMES CLARK ROSS courtesy of British Antarctica Survey and Swan Hunter Shipyard.)

NOAA'S OCEAN FLEET MODERNIZATION STUDY

Phase 3: Long-Term Strategy

OCTOBER 1990

U.S. DEPARTMENT OF COMMERCE
Robert A. Mosbacher, Secretary

National Oceanic and Atmospheric Administration
John A. Knauss, Under Secretary

Office of the Chief Scientist
Ned A. Ostenso, Acting Chief Scientist

Acknowledgement

Thanks to several very dedicated individuals, a thorough analysis of the status of NOAA's existing research and survey fleet, in terms of condition and functionality, was completed and a series of options for fleet modernization were developed. Deserving much credit for this accomplishment were representatives from each of the NOAA Line Offices, and from several of the Staff and Program Offices. Representatives from the Oceanographer of the Navy's staff deserve recognition for their contributions. Deserving special recognition are persons from the Office of NOAA Corps Operations, Systems Technology Division, who completed the bulk of the technical analysis which served as the basis for the determinations and findings of this study.

To all contributors, many of whom participated at the expense of other responsibilities and sometimes on their own time, we extend our appreciation. NOAA and the Nation's maritime and research community will profit from their effort and insight.

Robert H. Stockman
Phase III Coordinator

W. L. Stubblefield
Assessment Coordinator

October 1990

Preface

To assess the next generation of NOAA ships, a three-phased process was initiated. Phase I identified the mission requirements from a user viewpoint; Phase II developed identifiable hull and instrumentation characteristics from these requirements and addressed fleet management issues; and, Phase III examined the characteristics developed in Phase II in light of vessels now in NOAA's fleet, and determined long-term strategies for implementing fleet modernization. This report addresses only Phase III.

Funding for NOAA's fleet has been approximately constant over the last decade, and the operating capability has been seriously eroded by inflation. By the end of the century, if funding remains level, there is a high probability that no NOAA ships will be operational. This is a conservative estimate based on the material condition, the age, and backlog of critical maintenance.

With reduced operating funds fewer NOAA ships are now in service than at any time since the early 1970's. The decline is at a time when progressively more demands are being made on NOAA ships. Added to the nautical charting, oceanographic research, and fishery assessment programs pursued at the time of NOAA's formation are new requirements associated with Congressional legislation and major new ocean programs. Included in these are the Magnuson Fishery Conservation and Management Act, Marine Mammal Protection Act, Exclusive Economic Zone proclamation, Climate and Global Change research initiative, and Coastal Ocean Program research.

NOAA data and samples are useful to the entire maritime and ocean research community. The size, quality, and character of NOAA's fleet may well determine the overall success of the marine sciences in the United States and abroad.

Through this study, NOAA now has a series of options for implementing fleet modernization. Equally important, a means for estimating the cost to implement the various options is also available. A point of departure for evaluation of the options has been established. Policy decisions will ultimately determine the fleet character and mix. This study establishes a point of departure for these decisions.

John A. Knauss
Under Secretary for Oceans and Atmosphere
and Administrator

Table of Contents

Executive Discussion

Background of Study

NOAA is increasingly viewed as the Nation's earth systems agency with unique responsibilities to improve understanding of the coastal and global oceans through research, assessment, surveying, and long-term monitoring. To accomplish its ocean missions, NOAA's efforts focus on three major components: charting and mapping, assessment of living marine resources, and oceanographic research. These components each have unique requirements, and must be accomplished on highly specialized vessels. The outlook is for an increasing need for more sophisticated platforms and instrumentation.

NOAA depends upon its research and survey fleet to satisfy its ocean missions. This fleet now faces several major problems in supporting its mission: age, a backlog of deferred maintenance, and, in some instances, a restriction in functional capability. The fleet is rapidly approaching an average age generally accepted within the marine science community as the maximum for a productive vessel. Prevailing practice is that research and survey vessels should undergo a major service-life extension after approximately 15 years of operation and be replaced after approximately 30 years. Though there are exceptions, the majority of both national and foreign oceanographic vessels follow this practice. In contrast, the current NOAA fleet will average nearly 35 years of age by the turn of the century (Figure 1-1). Furthermore, none of the NOAA ships have received a major service-life extension and only six have received partial midlife rehabilitation. Even the NOAA ships which have been well maintained have started experiencing unacceptably high levels of breakdowns due to their age, the scarce availability of replacement parts, and limited budgets for maintenance in recent years. For example, in FY 1989, the equivalent of one ship year was lost due to unscheduled maintenance and repair.

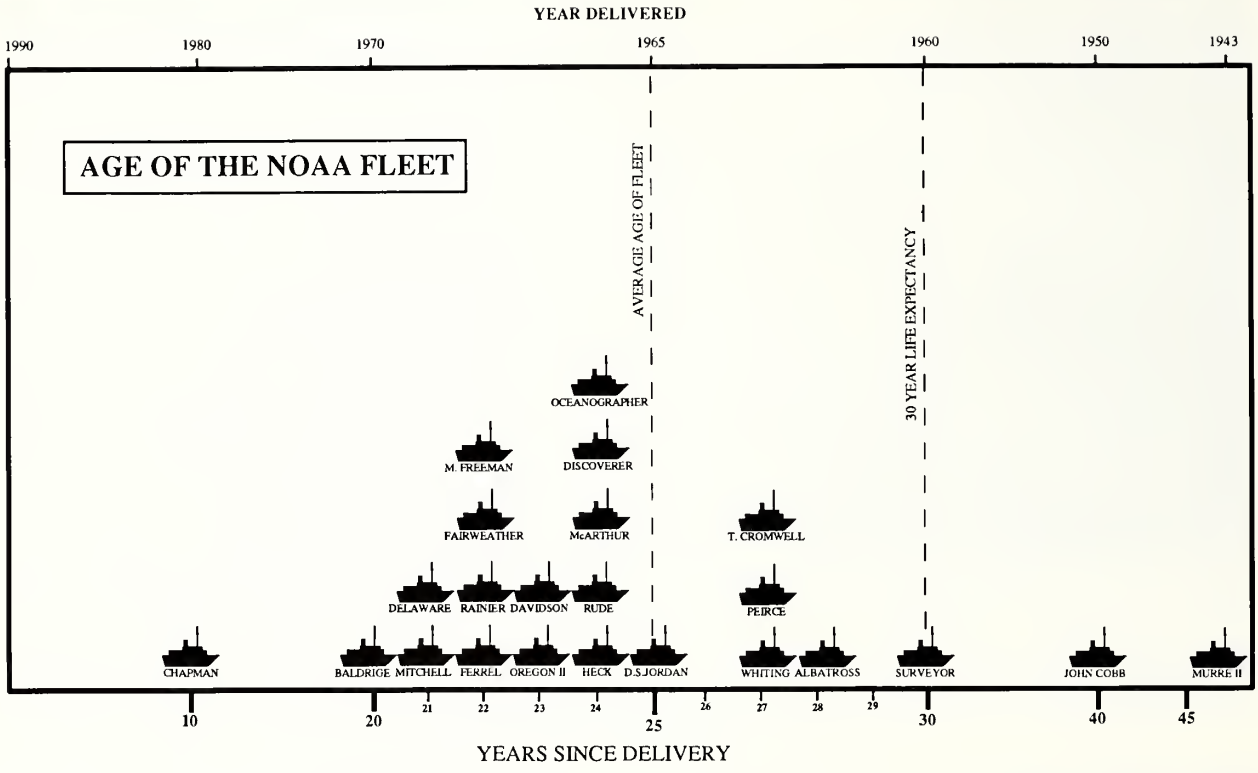


Figure 1–1. *Age of the individual NOAA ships in 1990. Note that only one ship, the CHAPMAN, has been built since the formation of NOAA.*

Of comparable concern is the fact that some NOAA vessels cannot fully meet recognized mission requirements. Virtually all NOAA ships were built with the technology of the 1960's to satisfy specific oceanographic objectives of that era. Since that time there has been a dramatic evolution in methods for collecting and analyzing bio–hydro–lithosphere oceanographic data. Acquisition science and analysis of these data place demands on vessels which often cannot be met by the present generation of NOAA ships.

This problem is not unique to NOAA vessels but is characteristic of any vessel built two to three decades ago and which has not had the benefit of a major repair or refit. New designs of vessels now provide increased efficiency in operations requiring acoustic quietness, seakeeping, and dynamic positioning. Those NOAA ships involved in multidisciplinary research are also inefficient in terms of the number of scientists which can be carried. On some of the NOAA ships the ratio of crew to scientist is as high as 2:1, whereas on the university ships a ratio of 1:1 is common.

This difference of crew to scientist ratio is due in part to additional responsibilities that are assigned to the staff of the NOAA vessels. A more modern fleet will provide opportunities for reduction of some crew positions through acquisition of more modern instrumentation and new ship design. Automated engine rooms and more efficient food service systems also provide an opportunity for reducing crew size.

Study Plan

Phase III embodies the objectives of the overall fleet modernization assessment. These are to:

- Articulate the ocean mission of NOAA in the areas of charting/mapping, living marine resource stock assessment, and oceanographic research into the next century
- Determine the character and size of research and survey vessels to form a fleet to respond to NOAA's ocean mission requirements
- Anticipate future technology and its application to NOAA's mission
- Develop a technical framework to decide an orderly replacement and/or upgrade of the existing fleet considering both material condition and functional capability
- Determine cost estimates for fleet modernization associated with various mission requirement levels
- Provide a technical data base for preparing a fleet modernization plan that will be defensible in the federal funding process

The central theme of the NOAA fleet modernization assessment has been a view toward the future. To ensure that this was achieved the assessment was designed around a three-phase approach that avoided undue emphasis on existing vessel capabilities too early in the process. In a serial process, NOAA's mission requirements were projected to the year 2000 (Phase I); the type of platforms needed to satisfy these requirements were defined (Phase II); and lastly, the size of the modernized fleet was determined at various program levels and transition scenarios were prepared to replace the current fleet (Phase III). Each phase was designed to stand alone but took account of data obtained during previous phases. For example, the estimated cost structure, which is presented in the latter parts of this Phase III report, is based on the functionality requirements and construction/instrumentation costs as developed in Phases I and II. The complete process was designed to be finished within six months in order to allow for timely decision making to resolve NOAA's deteriorating fleet problems. Specifically, the objectives and approaches of each of these three phases are shown in the box on the next page.

This report addresses only the results of Phase III of the assessment. Results of the other two phases have been presented as separate documents.

Implementation of Phase III

In Phase III, the Working Group (a list of participants appears in Appendix C) reviewed the results of the previous phases and collected new information in order to get a "total view" of the issues associated with fleet modernization. Among other issues, this included determining: the status of the existing fleet in terms of material condition, functional capability, and deployment; annual number of days at sea on various types of ships to support programmatic requirements; mission consequences of having either the wrong type of vessels or an insufficient number of vessels; use of technology in promoting efficiency of at-sea operations; and, where appropriate, exploring opportunities for using leased ships from either the university community or the private sector to satisfy NOAA's needs. After the "total view" was developed, a series of alternatives for fleet modernization were identified. These alternatives were, in turn,

analyzed in terms of impact on the varying missions, level of urgency for implementation, short– and long–term costs, and budget constraints. Following the analysis of alternatives, a series of recommendations involving actions for proceeding to decisions and implementation of the fleet modernization are presented. The various facets of Phase III are discussed in the following chapters. A synopsis of the findings and recommendations follows.

Highlights of Phase III

Status of Current NOAA Fleet. NOAA depends heavily upon its oceanographic fleet to satisfy its ocean missions in the areas of charting and mapping, assessment of living marine resources, and oceanographic research. The existing operating fleet of 18 ships poses three problems to NOAA's scientists and managers. First, the average fleet age is approaching that which is generally accepted

Plan of NOAA Fleet Assessment

Phase I

Objective: **Determine NOAA's ship requirements as part of the Organization's mission into the next century.**

Method: **Convene three working groups of twelve to fifteen members each, consisting of leading scientists, both inside and outside of NOAA, in the areas of oceanography, charting/mapping, and fishery research, to determine the expected mission directions and fleet requirements to satisfy expected mission directions.**

Phase II

Objective: **Translate the results of Phase I into identifiable hull characteristics and instrumentation requirements.**

Method: **Convene a single working group with representation from the previous working groups, naval architects, operators, and budget analysts to incorporate the results of Phase I into specific platforms and associated instrumentation.**

Phase III

Objective: **Develop long–term strategies for modernization including sizing of the fleet.**

Method: **Senior NOAA managers convened to compare the projected mission requirements in terms of ship character (Phase II) and days at sea with existing NOAA fleet resources to determine the best methods of transitioning to a modern fleet capable of meeting NOAA's missions.**

in the ocean community as the effective service life for a productive research ship. By FY 2001, as the result of block obsolescence and assuming current funding, there will be no ships operating. Second, NOAA ships were built with technology of the 1960's; in the past three decades a dramatic evolution in methods for collecting and analyzing data has occurred. Data acquisition and analysis place requirements on vessels which often cannot be met by existing NOAA ships. Third, increasingly, more days at sea are required to satisfy NOAA's missions. Since the mid-1970's, the number of operating ships has been reduced by 25% while demands have increased, especially the at-sea requirements associated with the Magnuson Act, National Climate Program Act, Exclusive Economic Zone proclamation, Climate and Global Change Program, and Coastal Ocean Program.

Upgrade Strategy and Funding. Unquestionably, NOAA must embark upon at least a partial replacement and, for those few existing ships which may be appropriate, a ship service-life extension program. This assessment study addressed several approaches for modernizing NOAA's fleet, but the inescapable conclusion is that a 15-year investment on the order of $1 billion is required. A time-phased investment strategy is the only reasonable course of action. This assessment study advocates as the first order of priority the commitment to an initial investment of at least $60 million per year for each of the first five years of a NOAA fleet modernization program.

Findings

Finding #1: ***RESEARCH AND SURVEY VESSELS ARE ESSENTIAL FOR NOAA'S MARINE AND ATMOSPHERIC MISSIONS.***

Based upon a review of materials from Phases I and II, as well as various reports from the University National Oceanographic Laboratory System (UNOLS) and foreign operators, operational and research missions involving oceanography simply cannot be performed without use of research and survey vessels. Great advances have been made during the last twenty years in aircraft and satellite remote-sensing as well as unmanned instruments and buoys, and these advances will continue to contribute significantly to oceanography in the future. However, research and survey oceanographic vessels remain the only platform for certain kinds of observations at sea and virtually all *in situ* sampling must be performed from vessels. This finding has been made by other federal organizations active in the marine sciences, and they have expended planned capital investments of over $300 million for oceanographic vessels since 1980 (Figure 2-1). During the same period NOAA has invested nothing.

Finding #2: ***THE CONDITION OF NOAA'S FLEET IS A MAJOR PROBLEM IN THE CONDUCT OF NOAA MISSIONS.***

With the exception of the construction of the 125-foot CHAPMAN in the late 1970's, all NOAA vessels predate the establishment of NOAA and are largely a product of major capital investments in the early-to-mid-1960's. NOAA has never had a systematic capital investment program for its vessels,

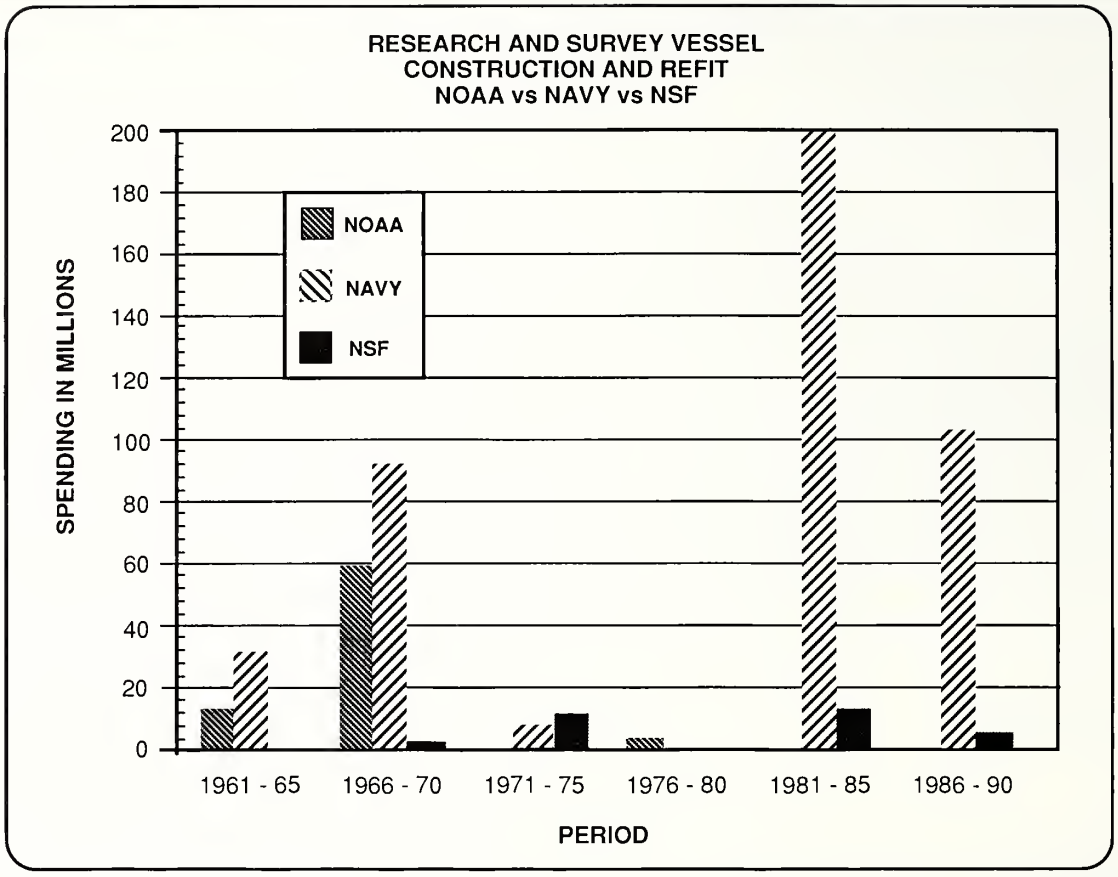


Figure 2–1. *Comparison of capital investments in ships among the Navy, the National Science Foundation, and NOAA since 1960. Figures for 1961–1970 are for NOAA's predecessor organizations.*

either for major rehabilitation or for new construction. The base program for marine services (approximately $60 million in FY 1990) includes only $6 million for routine maintenance and repairs. At present NOAA has a $40 million backlog of critical maintenance items in ship's systems. Added to this is a $50 million backlog for replacement of obsolete instrumentation. Given the age of vessels in NOAA's fleet, the fact that no vessel has had a major service life extension, and the current material condition of the fleet, it is projected that all NOAA vessels will become non-functional by the year 2000 if no capital investments are made above the marine services basic program. The projections of remaining vessel service life are based on age, safety, material condition, availability of spare parts, functionality, and, in the case of steam propulsion, availability of qualified engineers (Appendix A). Figure 2–2 depicts the projection of service life for each NOAA vessel.

Finding #3: ***PROJECTED NOAA MISSION REQUIREMENTS WILL INCREASE THE NEED FOR MODERN, TECHNICALLY CAPABLE, FUNCTIONALLY SOUND VESSELS.***

The NOAA fleet supports three major mission activities: mapping and charting, living marine resource assessment and research, and oceanography. Each of these mission

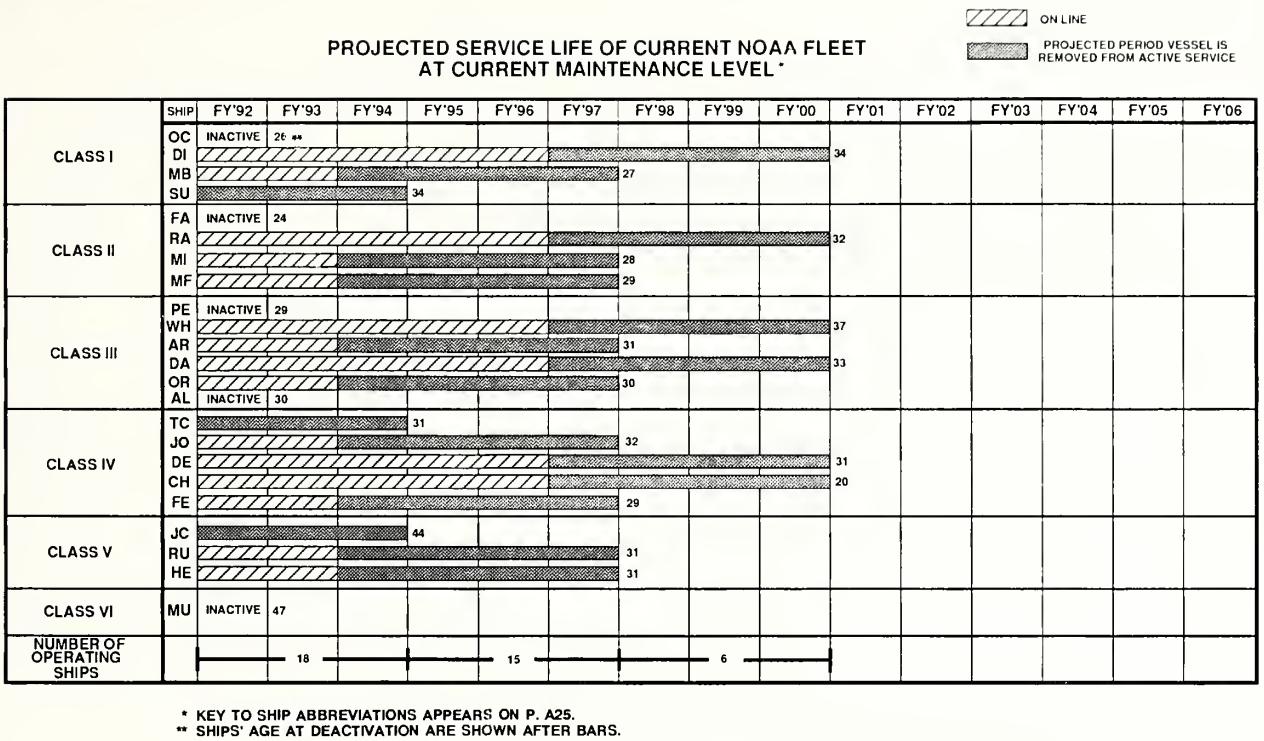


Figure 2–2. *Projection of service life for NOAA ships (a list of abbreviations for ship names appears in Appendix A, p. A25).*

requirements for vessels, over the next one to two decades, are summarized in Appendix B. A more detailed discussion of NOAA's ocean missions and the functional requirements for vessels to support these missions are in the Phase I report of the Fleet Modernization Study. In terms of days at sea (DAS), these mission requirements can be grouped as:

Current Level: Present level of support with 18 ships

Expanded Levels: Increased number of ships to support programs

Planning Level A: Supports programs which are in NOAA's present budget

Planning Level B: Supports programs in NOAA's FY 92 budget request

Planning Level C: Supports programs envisioned at the end of the decade

Descriptions of each of these levels follow.

CURRENT LEVEL

At the CURRENT LEVEL, the NOAA fleet provides 3600 DAS annually to support three major program activities. DAS are allocated as follows: mapping and charting, 1100 DAS; living marine resources, 1540 DAS; and oceanography, 960 DAS. This level ***provides 84% of the average DAS over the past 15 years*** (Figure 2–3).

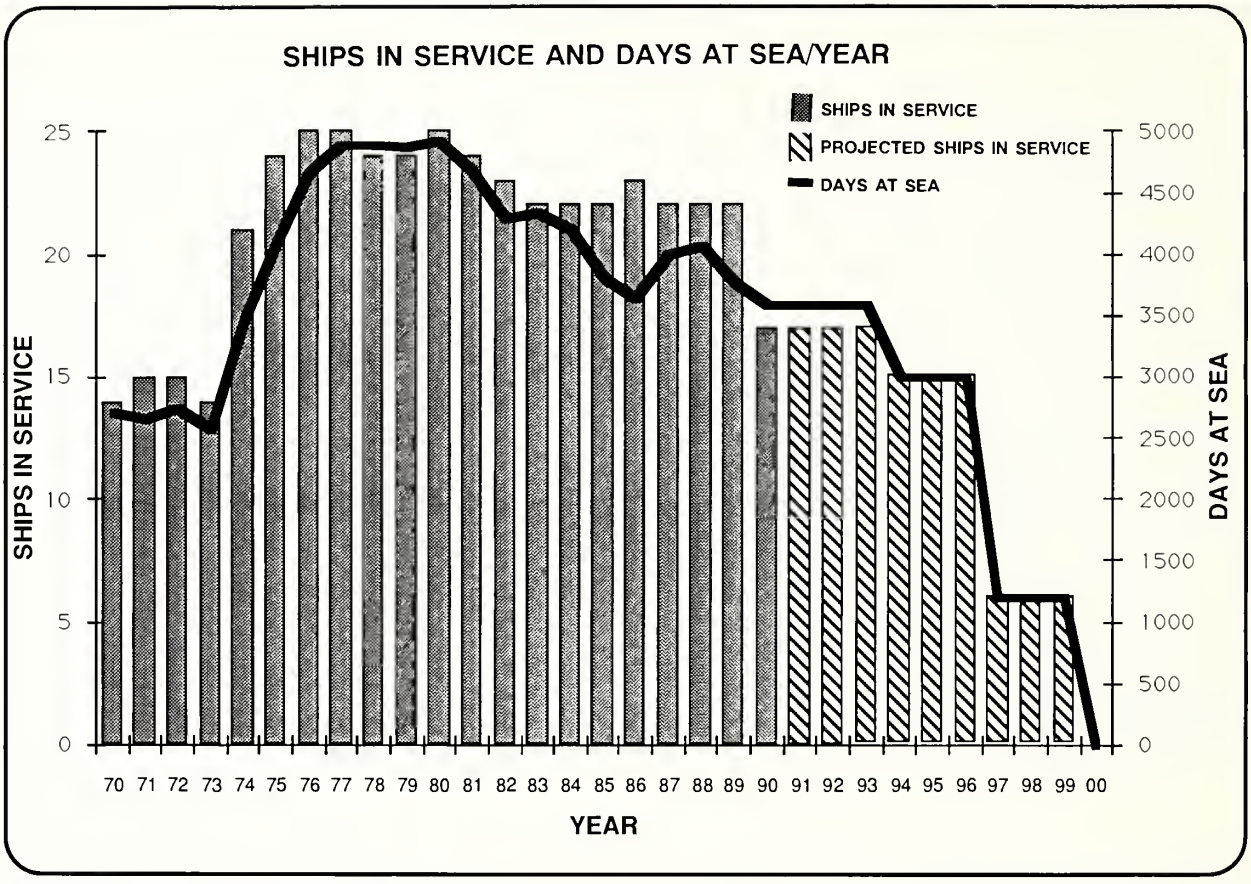


Figure 2–3. *Bar graph showing the number of operating ships during the 20 years since the organization of NOAA and the projection of the number of vessels for the next decade. The projection is based on the material condition of the various ships. Superimposed on the number of vessels is the number of sea days available or projected to be available per year.*

Mapping and Charting: With 1100 DAS, the mapping and charting program is receiving approximately 465 fewer DAS annually than the 15–year average. At this level, surveys and investigations critical to navigational safety are backlogging at an alarming rate. Only 4 out of the 10 critical inshore areas identified each year through the use of Survey Users Request File (SURF) are being addressed––the remaining 6 areas are being added to the backlog (not being addressed) (Figure 2–4).

Only 100 of the 500 critical Notice to Mariner items each year are being addressed. The remaining 400 items are added to the backlog (Figure 2–5). The quality of the information portrayed on the inshore portion of NOAA's suite of 1000 nautical charts is deteriorating.

Offshore, only 3 of 5 geographic areas are being addressed. Even with state–of–the–art navigation and multibeam sounding technology, completion of offshore mapping will take over 200 years (Figure 2–6). In those areas where the high–precision bathymetric mapping occurs, the quality of the offshore portion of NOAA's nautical charts will slowly improve.

Living Marine Resources: The present level of NOAA ship support is about 400 DAS below the average of National Marine Fisheries Service (NMFS) usage over the past 15 years. This is inadequate for all program

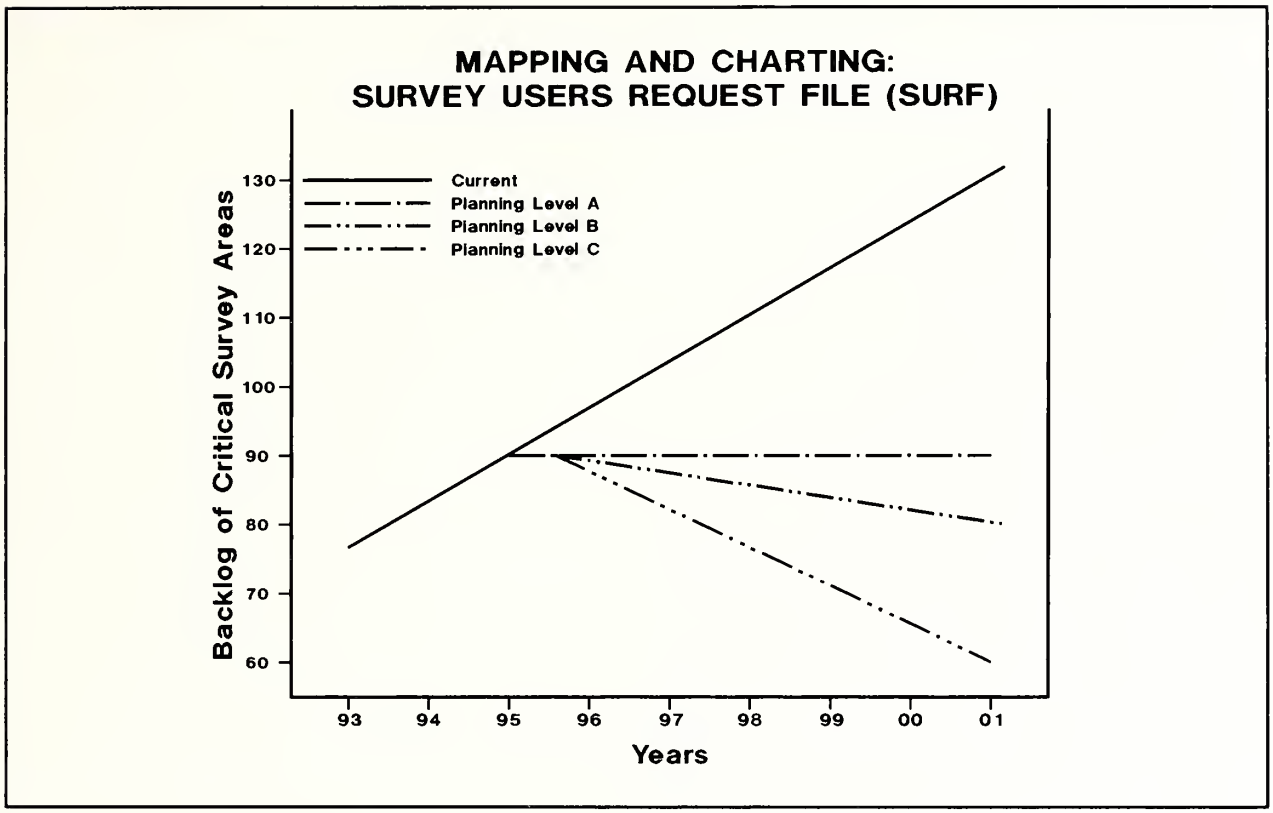


Figure 2–4. *Growth and decay of nautical charting surveys in the critical areas as defined by Survey Users Request File (SURF) are shown at four levels of ship support. (Programmatic support levels are discussed in text.)*

areas in fishery research, but particularly in resource assessment (Figure 2–7).

Oceanography: Presently oceanography in NOAA's Office of Oceanic and Atmospheric Research (OAR) and National Ocean Service (NOS) is allocated fewer DAS than at any time since NOAA was formed, and is inadequate to meet present mission responsibilities. The level of oceanographic research which can be accomplished is severely restricted, with almost no new responsibilities as part of the Climate and Global Change program being met, and other research programs continuing at a reduced level (Figure 2–8). A breakdown of the results of this shortfall follows.

Climate and Global Change Program:

- Reduced level of effort over the average of the past 10–15 years
- No opportunity to implement significant new program elements
- Monitoring efforts for El Niño (ocean warming) and Subtropical Atlantic Climate Studies (STACS) (flux of heat from low to high latitudes) are reduced to approximately 35% of the level considered optimum for addressing the complex array of questions. Long-term support for certain key ocean monitoring systems for TOGA and EPOCS may need to be terminated

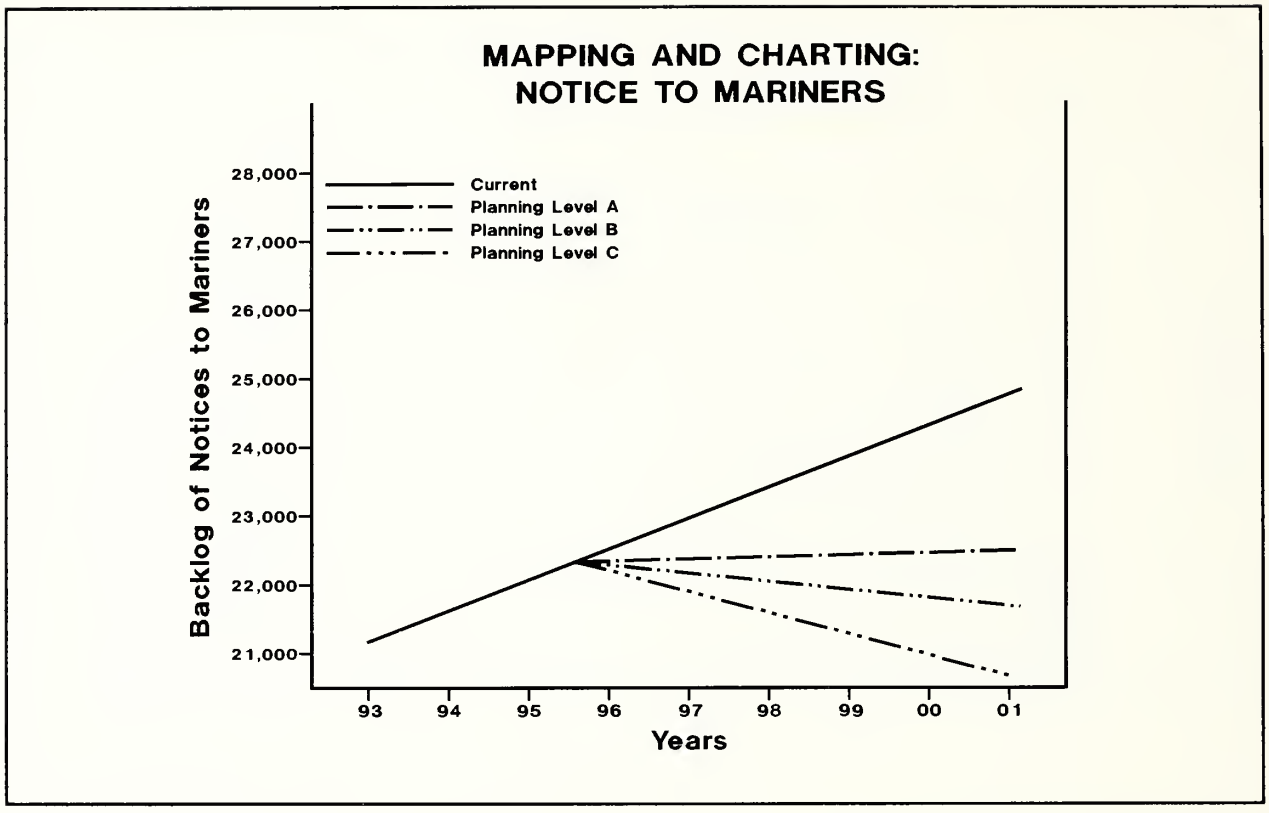


Figure 2–5. *Growth and decay of nautical charting surveys in the critical areas as defined by the Notice to Mariners are shown at four levels of ship support. (Programmatic support levels are discussed in text.)*

- Ocean chemistry programs (e.g., Radiatively Important Trace Species (RITS), CO_2, and Freon) for monitoring global greenhouse gases are reduced significantly over both past and required efforts. These programs are essential components for modeling global climate change

- Proposed investigations combining NOAA's greenhouse gases research and observations for the World Ocean Circulation Experiment (WOCE) work from Alaska to 60° South latitude are eliminated

Coastal Ocean Program:

- Reduced level of implementation for planned cooperative federal/university research

- Marine environmental quality efforts in coastal estuaries is only 50% of identified needs

- Nutrient Enhanced Coastal Ocean Productivity (NECOP) program reduced by 50% over that planned

- Sea ice research is less than previous years and, considering its importance in global climate research, is only 50% of that needed for present investigations

- Ship time for the Fisheries Oceanography Cooperative Investigations (FOCI) program in the Bering Sea is eliminated

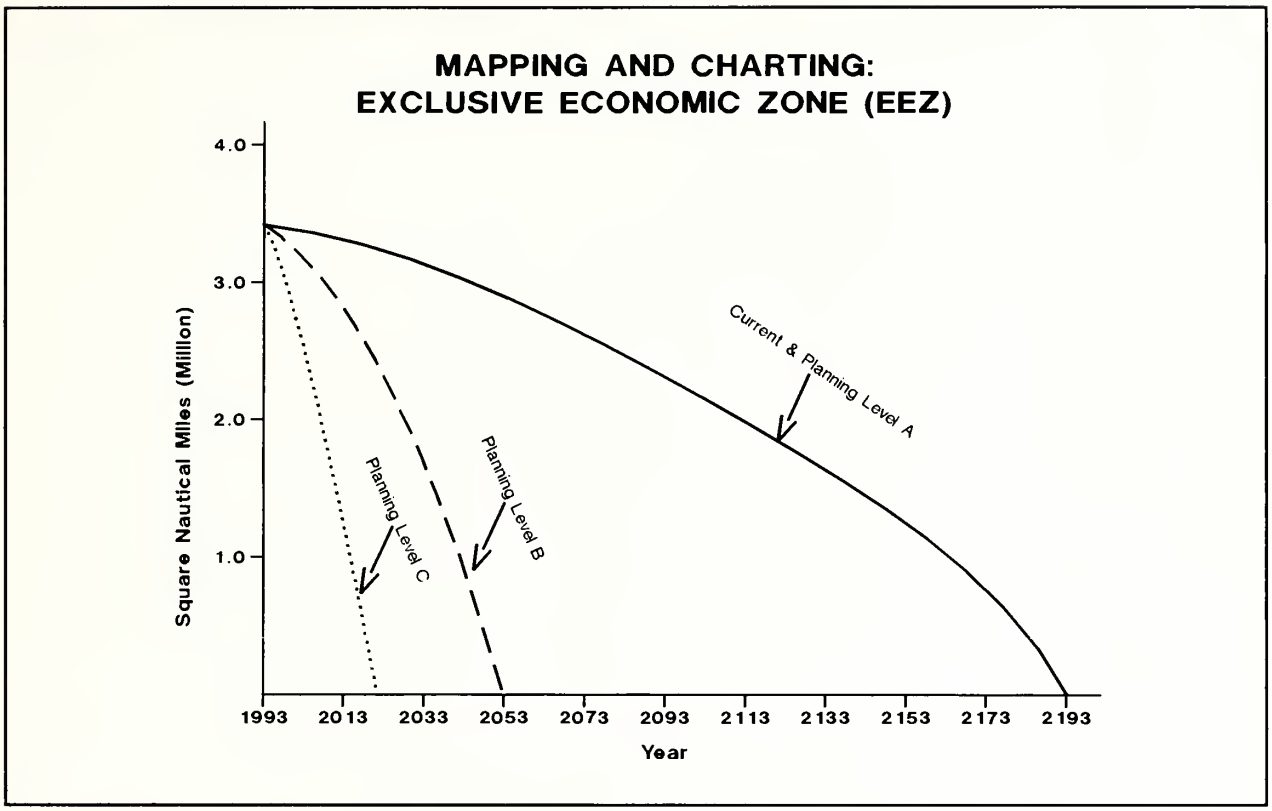


Figure 2–6. *Time required to complete the offshore Exclusive Economic Zone (EEZ) mapping responsibilities at the various ship support levels. (Programmatic support levels are discussed in text.)*

Applied Oceanography:

- Planned expansion of monitoring network to Alaska and Caribbean is deferred
- Cooperative monitoring with Environmental Protection Agency (EPA) is unsupported
- Surveys for current prediction in U.S. ports and harbors deferred
- Environmental assessment of the outer continental shelf relative to oil and gas development maintained at a marginal level
- No support for hazardous material response and damage assessment

EXPANDED LEVELS

PLANNING LEVEL A

At this level ship support would increase to 6100 DAS annually with mapping and charting receiving 2160 DAS, living marine resources 2470 DAS, and oceanography 1470 DAS. ***This level supports presently funded NOAA programs.***

Mapping and Charting: All 10 inshore areas identified through SURF each year and all 500 Notice to Mariner items would be addressed. The present backlog for these two critical programs would remain unchanged. The quality of the information portrayed on the inshore portion of NOAA's suite of nautical charts would remain constant. There would

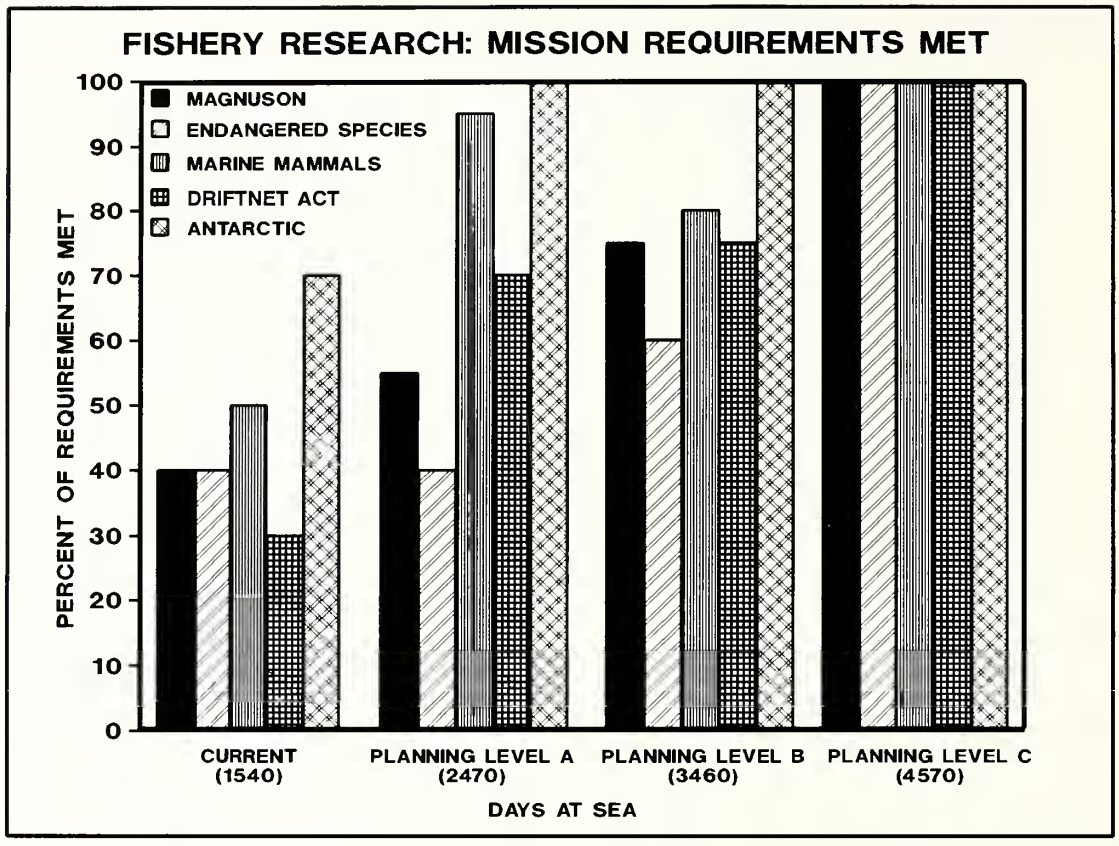


Figure 2–7. *Percent of fishery research requirements met at various levels of days at sea (DAS). (Programmatic support levels are discussed in text.)*

be no change in progress for the offshore bathymetric mapping effort from the CURRENT LEVEL noted above.

Living Marine Resources: This level would be adequate for existing base programs, and would provide:

- Expansion of groundfish assessment, large pelagic species assessment, environmental assessment in the Atlantic Bight
- The initiation of a modest assessment of the protected resources in the northeast
- A small increase in the support of critical fishery management issues in the Gulf of Mexico
- Some support for the Coastal Ocean Program
- Optimum ship support for the Antarctic survey
- Slight increase for the groundfish assessment and coastal marine mammal assessment in the southwest
- A modest increase of groundfish assessment in the Gulf of Alaska, modest environmental assessment in Puget Sound and southeast Alaska
- Some transboundary (Canada–U.S.) salmon migration studies

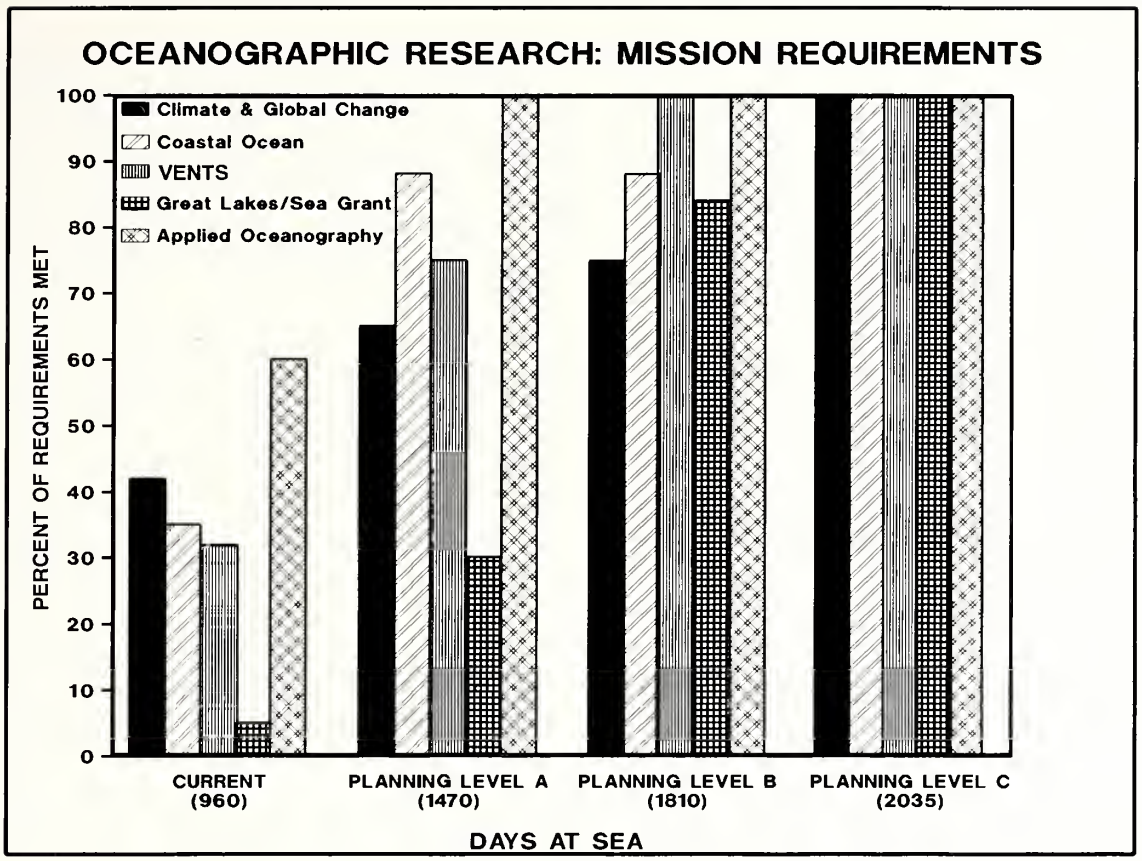


Figure 2–8. *Percent of oceanography requirements met at various levels of days at sea (DAS). (Programmatic support levels are discussed in text.)*

Oceanography: This level supports presently funded programs and would provide:

Climate and Global Change Program:

- Monitoring activities of Tropical Ocean and Global Atmosphere (TOGA), Equatorial Pacific Ocean Climate Studies (EPOCS), and STACS to continue at present levels
- Continuation of a limited Atlantic STACS program
- Ocean chemistry programs of RITS, CO_2, and Freon in the Pacific would continue at current levels
- Expansion of RITS/Freon and RITS/CO_2 into the Atlantic
- Elimination of proposed expansion to the ocean observing system
- VENTS work on the Juan de Fuca Ridge would be returned to previous levels
- Mid–Atlantic VENTS work restarted

Coastal Ocean Program:

- Sea ice research in support of the joint U.S./U.S.S.R. bilateral would be accomplished
- Expansion of the FOCI program into the Bering Sea

- Initiation of Nutrient Enhanced Coastal Ocean Productivity (NECOP) into the Gulf of Alaska and the Bering Sea

- A modest increase in support for Sea Grant research, up to approximately 30% of the perceived needs

Applied Oceanography:

- The National Status and Trends (NS&T) monitoring network would be expanded to Alaska and the Caribbean

- Existing network for coastal U.S. waters would be expanded to support the Coastal Ocean Program

- Cooperative monitoring with EPA's Environmental Monitoring and Assessment Program (EMAP) would be supported

- The majority of support for circulation studies would continue to be provided by Coast Guard and small charter vessels

- NOAA's hazardous materials response and damage assessment response operations remain unsupported

PLANNING LEVEL B

At this level ship support would be increased to 7910 DAS. Mapping and charting would receive 2640 DAS, living marine resources 3460 DAS, and oceanography 1810 DAS. For living marine resource assessment and oceanography, this level supports DAS for high-priority programs which are projected in the very-near future. For mapping and charting, this level supports base program requirements.

Mapping and Charting: At this level the two critical backlogs (inshore areas and Notice to Mariners needing survey attention) would slowly diminish. The quality of the information portrayed on the inshore portion of NOAA's suite of nautical charts would slowly improve.

- Offshore all five geographic areas would be addressed each year reducing projected mapping completion from over 200 years to approximately 60 years

- Quality of the offshore portion of NOAA's nautical charts would rapidly improve

Living Marine Resources: At this level significant increases in the support of protected resources assessment and the environmental assessment portions of the Coastal Ocean Program can be realized. Specifically:

- In the northeast and the southeast there would be full support of the Coastal Ocean Program plus some expansion in the assessment of protected species

- In the southwest a significant expansion of the coastal marine mammal, groundfish, and western Pacific resource assessment would be achieved

- Expanded fishery resource assessment in the Gulf of Alaska, Aleutian Chain, and central Bering Sea would be realized

- More aggressive activities in support of the Coastal Ocean Program

Oceanography: Enables accomplishment of essential elements in the programs, continuation of monitoring efforts, and some support for the observing system. Specifically:

Climate and Global Change Program: Provides for a reasonable response to the developing programs and continued support for a network of moored arrays. The following programs would be initiated:

- Monitoring of ocean/atmosphere exchange of greenhouse gases and heat in the Atlantic
- Atlantic climate change program
- Pacific sulfur/stratus investigations
- Measurements for ground truthing Earth Observing System (EOS) satellites
- Full support of VENTS work in both the Juan de Fuca and Mid-Atlantic Ridge would be achieved

Coastal Ocean Program would be expanded to include:

- Sea ice research in high latitudes leading to improved forecasts and knowledge of ocean productivity and circulation
- FOCI fisheries recruitment studies in the Atlantic and Gulf of Mexico
- Continuation of tsunami hazard reduction research
- Modest increases for marine environmental quality research in estuaries
- Required support of planned VENTS work in both the Juan de Fuca and Mid-Atlantic Ridge would be achieved
- Sea Grant research in support of Climate and Global Change, Coastal Ocean, and Great Lakes research programs would increase to approximately 80% of the perceived requirements

Applied Oceanography:

- The identified mission requirements would be fully supported
- Outer Continental Shelf environmental assessment programs would be fully supported

PLANNING LEVEL C

At this level ship support would be increased to 10,215 DAS. Mapping and charting would receive 3610 DAS, living marine resources 4570 DAS, and oceanography 2035 DAS. This level would support all program requirements foreseen through the end of the century and into the next. Mapping and charting backlogs would diminish rapidly and product quality would increase in a similar fashion. Bathymetric mapping of the EEZ would be completed in 30 years.

Finding #4: ***NEW TECHNOLOGIES ALLOW SIGNIFICANT INCREASES IN MISSION PERFORMANCE, PRODUCTIVITY, AND EFFICIENCY.***

Although NOAA has failed to take full advantage of them, technologies for oceanographic operations have burgeoned in the United States and abroad since the 1960's. Major innovations can be grouped into the following categories:

- *Automation of Vessel Operations* (e.g., unmanned engine rooms and streamlined food service)
- *Improved Seakeeping* (e.g., SWATH hulls which can operate productively in higher sea states than monohulls)

- *Improved Stationkeeping* (e.g., multi-directional thrusters permitting precise positioning under a wide range of conditions)

- *Increased Real-Time Data Analysis at Sea* (e.g., continuously recording sensors of a wide suite of environmental and physical data can feed shipboard and shore-side computers)

- *Reliable Communications Virtually Anywhere at Sea* (e.g., polar orbiting and stationary satellites)

- *Precise Positioning (in X, Y, and Z)* (e.g., satellite navigation and global positioning systems)

- *Advanced Instrumentation Multiplying Data Acquisition* (e.g., multibeam soundings, hydroacoustic resource surveys)

- *Modular Laboratory Technology Allowing Multipurpose Operations and the Opportunity for Sophisticated Sample Analysis at Sea*

The incorporation of these advances into new ships can provide a very high programmatic return for the investment.

Finding #5: ***NEW WAYS OF DOING BUSINESS ALLOW INCREASED FLEXIBILITY AND EFFICIENCY IN FLEET OPERATIONS.***

Oceanographic research and survey vessel operations are inherently costly, and the control of expenditures for capital investment, or for operations, is a continuing management objective. At any particular budget level available, cost control can allow more ship activity. The following categories of cost control show potential promise in the acquisition or operations strategies that NOAA employs for the fleet:

- *Crewing Efficiency* -- The vessel's crew can be considered an "overhead" cost compared to the scientific and technical staff who perform oceanographic missions. Scientist to crew ratios should be maximized as a cost control measure. Automated engine rooms and streamlined food services are mechanisms for reducing the crew size.

- *Crew Augmentations* -- Increasing the operating days at sea by multiple crewing can avoid the cost of an additional vessel in certain cases.

- *Chartering* -- As an alternative to up-front capital investments to acquire research and survey ships, chartering might be a very attractive alternative when the expected program requirements are of much shorter duration than the typical 30-year lifetime of a new ship. This alternative is also economically attractive when only a portion of NOAA's needs are met through chartering. For example, sufficient ships are available through the university community and the private sector to meet some of the program requirements. As suggested by Figure 2-9, where two vessels are chartered (10% of the fleet) the costs are less throughout the life history of the fleet. At the 20% level a similar trend exists.

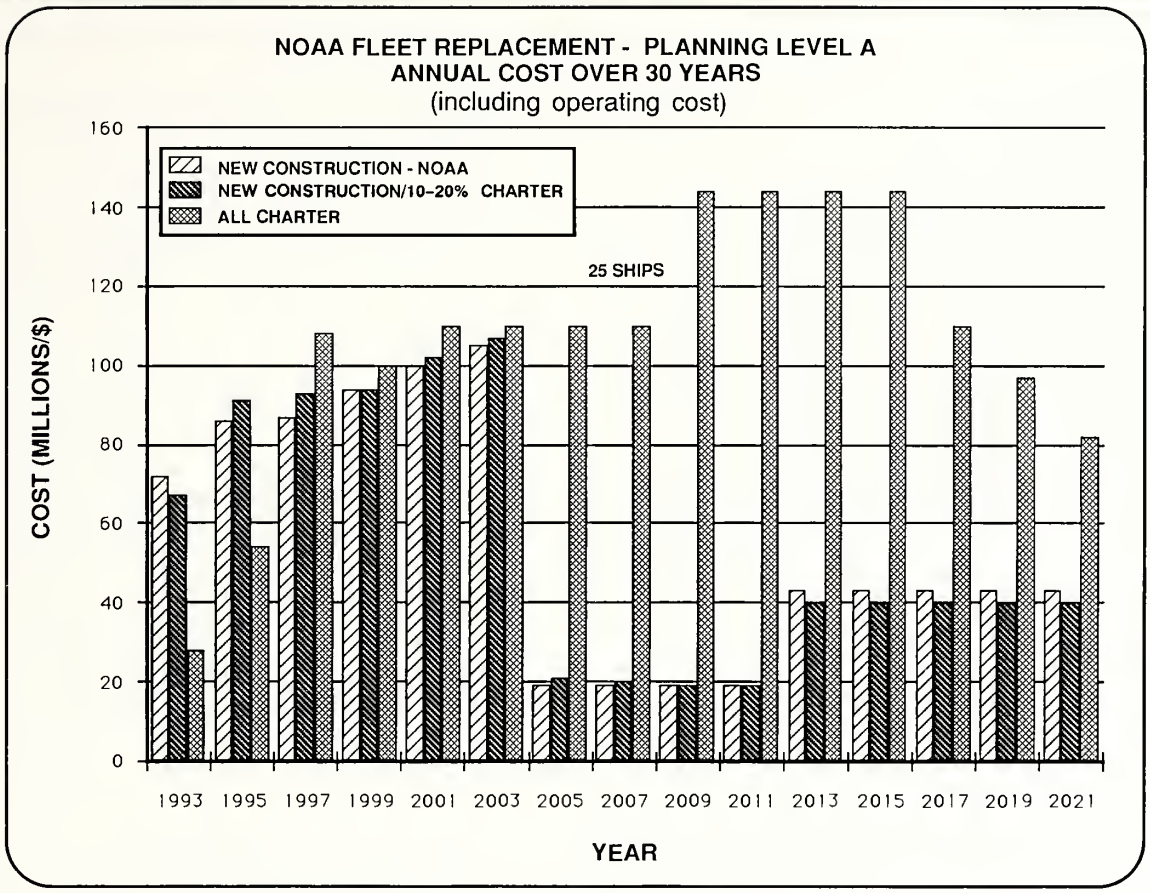


Figure 2–9. *Thirty–year comparison of costs associated with a NOAA–owned, 20% charter, and 100% charter options. These costs include the current $60 million annual funding for operating the NOAA fleet. The reduced costs at Year 2005 reflect completion of capital investment for construction and major repairs. The increase at Year 2013 reflects initiation of service–life extension costs.*

This savings from chartering must be viewed in the proper perspective. At present, there are no ships in the private sector equipped to satisfy all of NOAA's requirements in the areas of fishery research and mapping and charting. There are, however, vessels in the university fleet to meet some of NOAA's oceanographic research needs. NOAA has utilized these vessels in the past, and expects to do so in the future. The charter costs which NOAA has paid, and which are reflected in Figure 2–9, cover only operating expenses. Major capital investment, e.g., construction, service–life extensions, certain equipment and repairs, are now borne by the Navy or the National Science Foundation. Should NOAA become a large user of the university fleet, then NOAA will be expected to share the capital investment costs. Such cost sharing will increase the amount NOAA pays for the charter, an increase not reflected in Figure 2–9.

For more extensive use of chartered vessels, however, an adequate number of suitable ships are not available in either the university fleet or the private sector. In such cases, the contractors would be required to build or convert vessels at costs similar to what NOAA would incur on its own. Under such conditions, whereas for the first few years the cost between "NOAA Constructed" and "All Charter" is comparable, in the out years

the "All Charter" approach is much more expensive. The principal advantage of chartering in the long term is to maintain the annual costs at a low level by spreading out charter payments. Disadvantages include the tendency for existing vessels to be less than ideally configured for certain mission–related work.

- *Build/Lease* –– An alternative approach is to pursue a build/lease program in the private sector. This approach could be a 20–to–30–year bare–boat lease with an option to purchase the vessels at the end of this period for a nominal amount. While there are a number of variations to this approach, one method would be for NOAA to engage a private contractor to oversee the design, financing, competition for awarding of contracts, and the actual construction of the vessels. The vessels would be designed to NOAA's specifications based on extensive consultation with NOAA program officials and based on NOAA–wide needs. NOAA would not begin making lease payments for these vessels until they were actually delivered in satisfactory condition and finally tested.

  This approach could accrue a number of benefits to NOAA. First, NOAA would not have to assemble a large in–house capability to design and procure the construction of vessels. Rather, existing NOAA personnel would continually assess NOAA–wide requirements and develop specifications for incorporation in the vessel designs. Second, by imposing considerable discipline at the design stage and by working through a private sector general contractor, NOAA could avoid the problem of "change orders" and resultant cost overruns which often accompany the federal procurement of ships and other equipment. Third, with a goal of achieving the maximum efficiency in both vessel financing and vessel construction through a build/lease program, and by competing the financing and the construction costs through the general contractor, significant savings may be achieved.

  There are two additional advantages to this approach which are of significance. First, because a private sector build/lease program presumes private sector financing throughout the design, financing, and construction stages, NOAA would not require appropriations to make lease payments until the vessel was actually delivered and satisfactorily tested. Also, the near–term fiscal–year appropriation amounts would be significantly smaller than under a federal procurement approach; however, in the long–term the costs to NOAA might be greater. Finally, if NOAA vessels are determined as being eligible for financing under the Capital Construction Fund (CCF), significant additional savings are possible (Figure 2–10). Conservative estimates for these savings are 25 to 30% and may apply to both new construction and conversion. The CCF is a tax–deferred fund which allows participants to invest profits and defer taxes on these profits provided that when funds are withdrawn from the CCF, they are used to construct vessels which are deemed to be engaged in commerce. Originally, funds could remain in the CCF indefinitely. However, as part of the 1986 tax reform legislation, the amount of time that funds could remain in the CCF was limited to 25 years. Because a considerable amount was invested in the early 1970's, many of the participants in the CCF will be looking for shipbuilding opportunities, or otherwise face very large tax obligations.

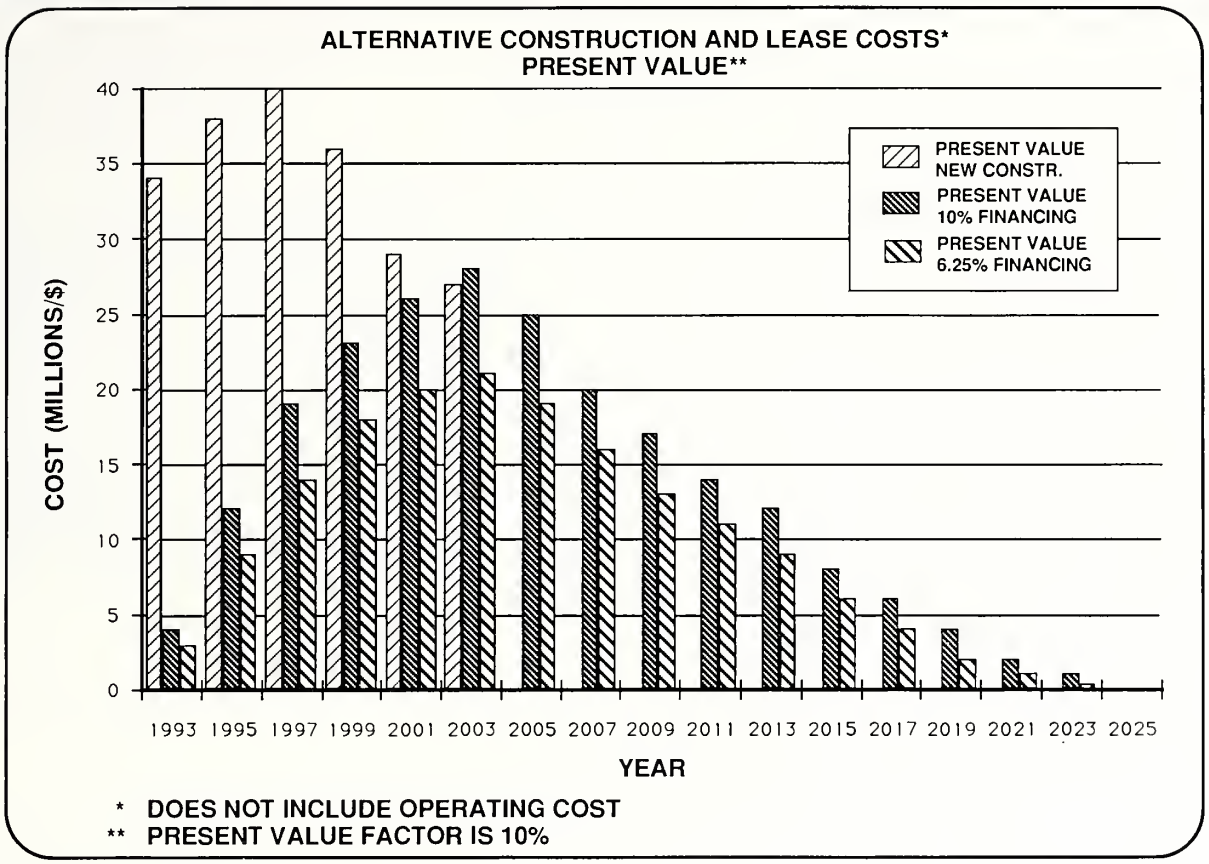


Figure 2–10. *Comparison of three approaches to financing. The "Present Value New Construction" reflects costs of appropriated dollars. The "Present Value 10% Financing" includes an offsetting 10% finance charge and an annual 10% discount (Present Value). The "Present Value 6.25% Financing" utilizes lower–interest funds such as Capital Construction Fund (CCF) (see text for discussion, pp. 19 – 20).*

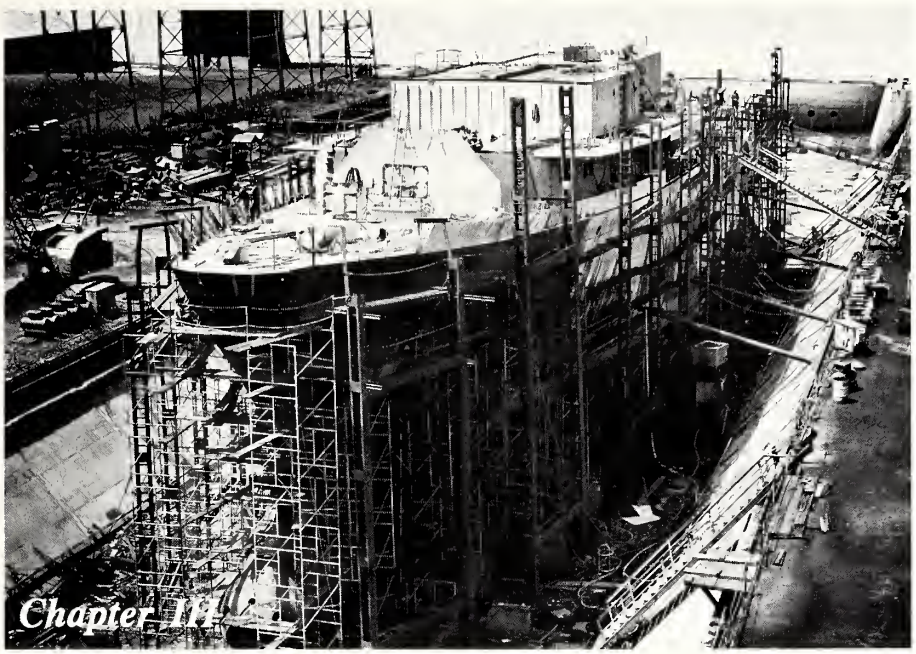
As a result, NOAA could benefit through significantly reduced costs provided waivers can be granted regarding the engagement–in–commerce requirements.

- *New Partnerships* –– NOAA could jointly construct or operate an oceanographic vessel with other federal organizations or a university, if all parties agree, as a means to share costs when all benefit.

NOAA's fleet is now the largest dedicated oceanographic research and survey fleet in the world. It is also one of the oldest and, in some cases, is functionally restricted. NOAA obtains oceanic observations and samples for its own mission requirements, particularly for monitoring, charting, and fisheries purposes.

Finding #6: ***REPLACEMENT OF NOAA'S FLEET IS A MAJOR OPPORTUNITY FOR NOAA LEADERSHIP IN THE MARINE SCIENCES NATIONALLY AND INTERNATIONALLY.***

Increasingly, NOAA data and samples are useful to the marine science community, especially in connection with monitoring and ground–truthing for expanding satellite remote–sensing programs. The size, quality, and character of NOAA's fleet will determine to a significant extent the quality of the marine sciences in the United States and abroad. NOAA's leadership can be pivotal.



Technical Assessment of Fleet Modernization

This section reflects the bulk of the detailed technical analysis undertaken in Phase III of the fleet modernization study. Fourteen distinct scenarios were examined and they are summarized in detail in Appendix A. These scenarios are based on the four missions levels: Current, Planning Level A, Planning Level B, and Planning Level C. The overall technical assessment examined the vessels required for each level, transition strategies given the current NOAA vessel inventory (especially its material condition), and associated costs. The fourteen scenarios cover all significant alternatives in the view of the study group and include operating at maximum levels for days at sea and various levels of chartering. For simplicity, the fourteen scenarios are condensed into five strategies which represent very different approaches to NOAA's fleet. Each of the five strategies, in turn, has several variants which allow flexibility to modify or fine tune each strategy as policymakers weigh choices. These five strategies are: (1) Rapid Degradation of Ocean Missions; (2) Slow Degradation of Ocean Missions; (3) Arrested Degradation of Ocean Missions; (4) Planning Level A/B; and (5) Planning Level C. Table 3–1 relates these strategies to the

MISSION REQUIREMENTS	STRATEGY FOR NOAA FLEET
Current (3600 DAS)	Degradation of Ocean Missions Rapid Slow Arrested
Planning Level A (6100 DAS)	Planning Level A/B
Planning Level B (7910 DAS)	Planning Level A/B
Planning Level C (10,215 DAS)	Planning Level C

Table 3–1. *Shown are the five strategies for the NOAA fleet as they relate to the mission requirements.*

mission requirements of Finding #3 in Chapter II, pp. 8 – 17. Each of these are discussed below.

Chartering. Except for "Rapid Degradation," which is not considered as an alternative, these strategies include some level of chartering. These chartering options are at levels of 10–20% and 100% of program needs. The charter option refers to long–term chartering from the university community [through the University National Oceanography Laboratory System (UNOLS)] or the private sector. In this context, it does not include build/lease options. Assumptions for the charter options include:

- NOAA obtains long–term charter authority
- Capability comparable to, or in excess of, those provided by the next generation of NOAA ships as identified in Phases I and II of the Fleet Modernization Study
- At 10–20% level of NOAA's program needs, sufficient ships are available to satisfy NOAA's needs
- At 100% level of NOAA's program needs, insufficient ships are available requiring vendors to build new ships. At the 100% level, costs were estimated on the basis of:
  - Construction cost amortized over 20 years at 10% interest
  - Mission/scientific equipment provided through government–furnished equipment (GFE)
  - Service–life extension completed after 15 years by vendor
  - Operating crew provided by vendor with mission/scientific crew provided by NOAA
  - Crew size varies from 12 to 21 depending on the vessel size
  - Existing NOAA shore–side support functions reduced by 50%
  - Maintenance costs are 30% of operating costs

Cost estimates are amplified in Appendix A.

An accurate determination of the cost for chartering will require sending a Request for Information (RFI) to potential vendors. For this study, such a request was premature and will await a subsequent cost–benefits study. Instead, historical data, including a study conducted by the Marine Board and published daily costs of the UNOLS vessels, are utilized.

CURRENT LEVEL: Rapid Degradation of Ocean Missions

Finding: With present funding, the probability is very high that within 10 years, few NOAA ships will still be operating. This stark fact is based on the material condition of the ships as documented by the 1988 ADVANCED TECHNOLOGY, Inc. study (*Report of Assessment and Plan to Extend the Service Life of Vessels of the NOAA Fleet, Vol. I: Plan; and Vol. II: Vessel Assessment and Analysis)* prepared for NOAA, which alarmingly highlighted a backlog of $40 million in critical maintenance, and $50 million in needed replacement of obsolete instrumentation. An unacceptable increase in lost days at sea due to unscheduled maintenance and lack of qualified operating crews already exists. In FY 1989 an

equivalent of one ship year was lost solely due to unscheduled maintenance.

Assumptions:

- No service-life extensions
- No increase in funding for maintenance except for adjustment for inflation
- Backlog of critical maintenance items will continue to increase
- Factors which govern the remaining service life:

  Safety
  Qualified Operating Crew
  Material Condition
  Availability of Spare Parts
  Age
  Functionality

- Life expectancy of 30 years; this is an optimistic expectation considering the lack of significant service-life extensions
- Based on the conclusions of the ADVANCED TECHNOLOGY study, and as detailed in Appendix A, the NOAA ships can be characterized in terms of material condition. From this the remaining service life is projected as:

  "Poor" an additional 0 to 4 years

  "Fair" an additional 3 to 7 years

  "Good" an additional 6 to 10 years

Based on the same study, the material condition, safety, age, and availability of spare parts the NOAA ships can be grouped accordingly:

Poor: SURVEYOR, ALBATROSS IV*, CROMWELL, J.N. COBB, MURRE II*

Fair: OCEANOGRAPHER*, DISCOVERER, BALDRIGE, MT. MITCHELL, MILLER FREEMAN, McARTHUR, OREGON II, JORDAN, CHAPMAN, FERRELL, RUDE, HECK

Good: FAIRWEATHER*, RAINIER, PEIRCE*, WHITING, DAVIDSON, DELAWARE II

* Presently inactive

As suggested in Figure 2-3, at this level of support the projection is that no NOAA ships will be operational by the year 2001.

CURRENT LEVEL: Slow Degradation of Ocean Missions

Finding: This option maintains the existing fleet of 18 vessels. Six ships will be replaced and 12 repaired to extend the service life at a 15-year cost of $332 million (Table 3-2). These costs are in addition to present funding for marine services, which is approximately $60 million per year.

Assumptions:

- Service-life extension and replacements through conversions will be completed in seven years
- Activating some presently inactive vessels and a fishery conversion vessel will be used to maintain the DAS level during the service-life extensions
- Upon completion of the service-life extension or replacement the ship operations will be increased to 240 DAS

15-YEAR COST SUMMARY OVER CURRENT FUNDING REQUIRED FOR FLEET MODERNIZATION AT VARIOUS OPERATING LEVELS

DAYS AT SEA (DAS)*	NUMBER OF SHIPS	15-YEAR COST ($M)			ANNUAL COST ($M)
		Capital	Operating	Total	
CURRENT - RAPID DEGRADATION (3600 DAS)					
SLOW DEGRADATION (4320 DAS)	18	277	55	332	22
ARRESTED DEGRADATION (4320 DAS)	18	672	64	736	49
ALL CHARTER (4320 DAS)	18	0	896	896	60
PLANNING LEVEL A (6100 DAS)					
240	25	920	222	1142	76
240 /10% CHARTER	23	838	266	1104	74
240 /ALL CHARTER	25	0	1465	1465	98
300	23	852	252	1104	74
300 /10% CHARTER	22	810	267	1077	72
PLANNING LEVEL B (7910 DAS)					
240	33	1139	361	1500	100
240 /10% CHARTER	26	915	540	1455	97
300	31	980	426	1406	94
300 /10% CHARTER	24	858	568	1426	95
PLANNING LEVEL C (10215 DAS)					
240	43	1472	446	1918	128
240 /10% CHARTER	36	1241	596	1837	123

* At 240 All Ships Operate At 240 DAS/Year; at 300 Larger Vessels Operate At 300 DAS/Year
M = Million

Table 3–2. *15–year cost summary.*

- Operating costs for a 240 DAS schedule have been included
- By operating at 240 DAS for each ship, the DAS for the total fleet will increase to 4320 from its present level of 3600 by FY 2000
- Service–life extension adds approximately 15 years to the life of the ship

CURRENT LEVEL: Arrested Degradation of Ocean Missions

Finding: At this level, the 18 ships presently operating will be replaced during the 15–year period. The ships in the poorest material condition will be replaced first; these include the SURVEYOR, CROMWELL, ALBATROSS IV, J. N. COBB, OREGON II, RUDE, and HECK.

To varying degrees the remaining ships will receive some repairs to extend their service life until they are replaced by new construction. The cost of this option over a 15–year period is $736 million over the present funding levels (Table 3–2).

Assumptions:

- Six ships replaced immediately with new construction
- Twelve ships will receive some level of repairs to extend life until replaced

- Activation of some presently inactive vessels and a fishery conversion vessel will be used to maintain the current days at sea during the period of repair for service-life extension
- The initial replacement and service-life extension will be completed in seven years
- After replacement or service-life extension are completed the ships will operate at 240 days per year. Consequently, by FY 2000 ship operations will be increased to 4320 DAS for the total fleet from current level of 3600 DAS
- The additional days at sea will increase operating costs

PLANNING LEVEL A/B

Finding: During a 15-year period all of the NOAA ships will be replaced. Also the size of the NOAA fleet will be increased in order to satisfy the mission requirements. The number of ships will range from 22 to 33 depending on the variant employed. With the variants of operating the larger ships at 240 or 300 DAS per year (small ships operate at 240 DAS) and employing no charter, 10-20% charter or 100% charter, the costs vary between $1.1 to $1.5 billion for the 15-year period over present funding of $60 million per year (Table 3-2).

Assumptions:

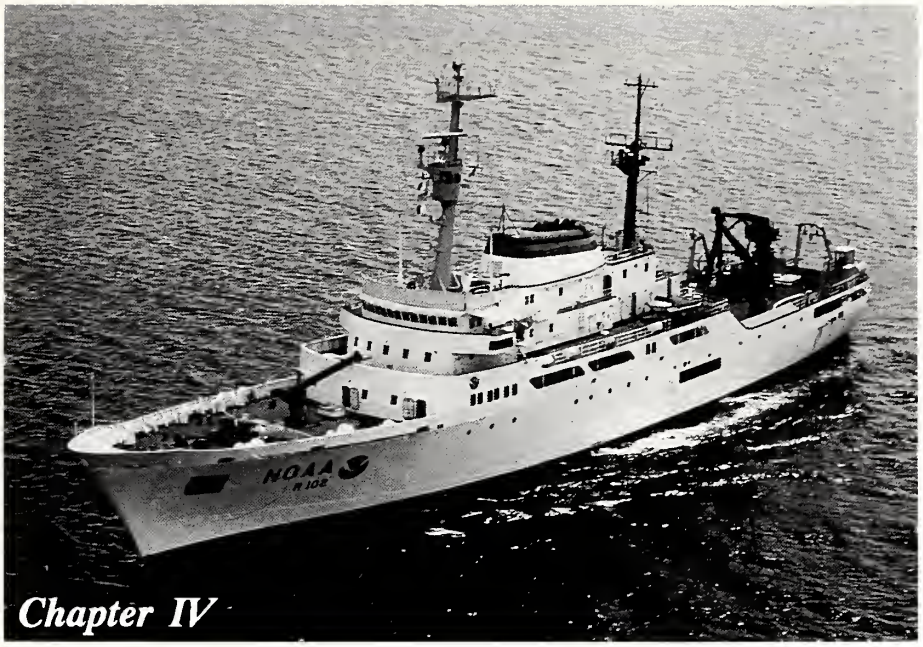
- New construction and repair to extend service life will be achieved through three 5-year periods. This will serve to spread the costs more evenly during the 15-year modernization period, to maintain a more constant annual days-at-sea level, and to avoid future block obsolescence
- Deactivated ships to be placed back in service to avoid loss in days at sea during the transition period
- The target increased days at sea will not be achieved until FY 2000
- Ships in poor material condition or functionally limited will be replaced early in the schedule
- Ships to meet new mission requirements to be constructed early in the schedule
- All schedules are for costing purposes only and are not intended to imply priority in repair, construction, or leasing
- At the 240 DAS level all new ships and those having received repairs to extend service life will operate at 240 DAS/year
- At the 300 DAS level only the High- and Medium-Endurance vessels (as identified in Phase II) will operate at 300 DAS/year; the smaller vessels will remain at the 240 DAS/year level
- Costs for days at sea above existing levels are included in the cost estimates
- At the 10-20% level of chartering, more large vessels will be chartered than smaller vessels; this is particularly true in the areas of charting and mapping, and living marine resource assessment

PLANNING LEVEL C

Finding: This level will satisfy all the identified mission requirements through 10,215 days at sea. The cost associated with the two variants of 240 DAS, no charter, and 10-20% charter are $1.8 and $1.9 billion above current funding level (Table 3-2).

Assumptions:

- Similar to those for the Planning Level A/B
- Starting in FY 1998 the OREGON II shifts from supporting living marine resources assessment to low–endurance oceanographic requirements
- Targeted days at sea will be achieved in FY 2005



Chapter IV

Evaluation of Capital Investment Strategies

This section presents an evaluation of the five alternative strategies for NOAA's fleet discussed in Chapter III. The intent is to weigh strategies, not particular packages, for specific numbers of ships, at firm costs, for a fixed program requirement level. It was the intent of the Working Group to maintain objectivity. In Chapter V, a detailed decision process to arrive at future specific investment decisions is presented for consideration.

CURRENT LEVEL: Rapid Degradation of Ocean Missions

Features: This schedule involves funding at the existing level at the expense of adequate sea days and vessel functionality to support NOAA's programmatic missions.

Pros:

- No additional money required

Cons:

- Progressive failure of ships
  --By FY 95 down to 15 ships
  --By FY 98 down to 6 ships
  --By FY 01 down to no ships
- With the existing ships less than 40% of NOAA's ocean mission requirements are now being met
- Several of the ships are functionally limited in support of today's ocean mission

CURRENT LEVEL: Slow Degradation of Ocean Missions

Features: This level involves the least amount of money to ensure that the current number of NOAA ships are operating at the end of the decade. Inherent to this schedule is the fact that for two-thirds of the fleet, which received a service-life extension, block

obsolescence will occur after 15 years. Needed functional capabilities and days-at-sea levels to meet identified mission requirements will not be achieved.

Pros:

- Less additional money than other options

Cons:

- For first three years annual cost is comparable to some of preferred modernization options
- Block obsolescence of two-thirds of fleet after 15 years
- Mission requirements not being met

CURRENT LEVEL: Arrested Degradation of Ocean Missions

Features: This is the minimum level to maintain a NOAA fleet into the next century and to avoid block obsolescence of the majority of the ships after 15 years. Needed days at sea to meet identified mission requirements will not be achieved.

Pros:

- Avoid block obsolescence
- Cost intermediate between "Current Level: Slow Degradation of Ocean Missions" and the preferred options of a Planning Level A or Planning Level B investment
- Functional capability assured

Cons:

- Not satisfying mission requirements in terms of days at sea

PLANNING LEVEL A/B INVESTMENT

Features: This level provides a functional fleet capable of satisfying those programmatic missions which are either funded (Planning Level A) or viewed as a high priority by NOAA (Planning Level B). Furthermore, if implemented as scheduled, future block obsolescence will be avoided.

Pros:

- Programs identified in NOAA's budget supported
- Functionality assured
- Future block obsolescence avoided
- Cost of the first three years comparable with less preferred options

Cons:

- More money than the previous options

PLANNING LEVEL C INVESTMENT

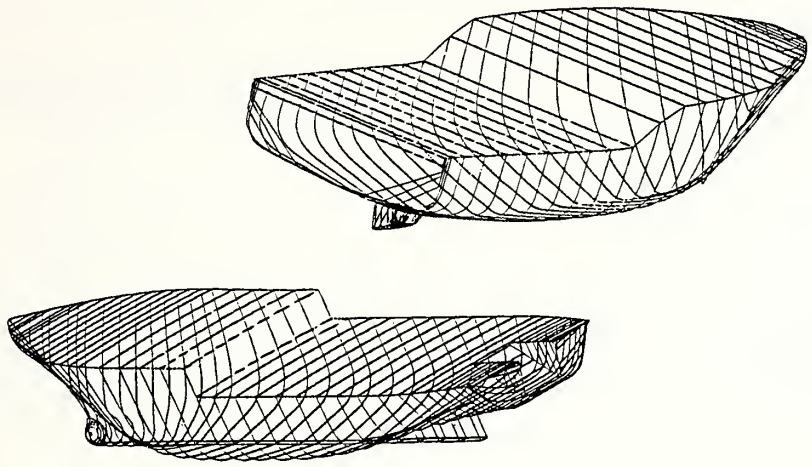
Features: This level provides sufficient functional ships to satisfy all of NOAA ocean mission requirements into next century.

Pros:

- Full support of NOAA's missions

Cons:

- More money than other options



Chapter V

Conclusions and Recommendations

Conclusions

Based upon the results of Phases I and II, and the additional material obtained or developed in Phase III, the Working Group arrived at the following conclusions with respect to the future of the NOAA fleet:

- ***An analysis of all significant alternatives to obtain a modern NOAA fleet to carry out NOAA's missions points to the conclusion that a 15-year investment on the order of at least $1 billion is required above the current base program of approximately $60 million per year***

- ***Future mission requirements and program funding levels are subject to change, and there may well be unanticipated technology breakthroughs; some flexibility to adapt to these changes is desirable. The Working Group concluded that an incremental investment strategy is the best way to assure that NOAA maintains the flexibility to meet its mission responsibilitie***

- ***As developed in this study, the fleet modernization plan can be tailored to a relatively broad range of funding levels in response to changes in NOAA's mission/program priorities. For example, if innovative private capital financing were selected, a 25-vessel fleet scenario could be funded with an annual budget level of approximately double the current base program of $60 million (i.e., $120 million per year total for operations and capital investment)***

- ***In order to take maximum advantage of the flexibility in obtaining vessel capability, NOAA would require legislative authorization for multiyear chartering. At present, long-term chartering (multiyear) cannot be undertaken by NOAA without legislative authorization***

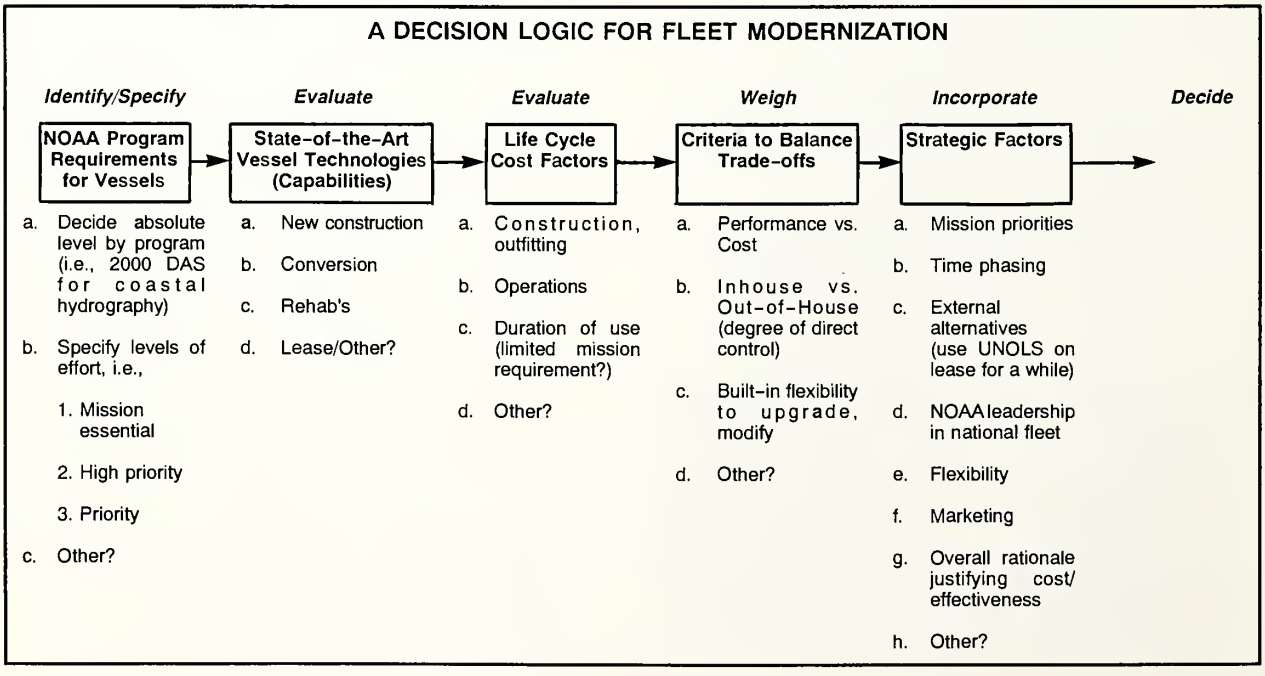
- ***The phased approach to fleet modernization as discussed in this study will not lock NOAA into a fleet of a particular size or character. This investment over the course of the 15-year program can be done in such a way as to preserve the choice of maintaining the NOAA fleet at a level responsive to the organization's evolving needs***

Recommendations

The Phase III Working Group adopted by consensus the following recommendations for NOAA action in support of the conclusions of the study:

- ***NOAA must maintain a ship capability to fulfill its mission and Congressionally mandated responsibilities***
- ***Fleet modernization should be an urgent, NOAA-wide priority***
- ***NOAA should propose a long-term, cost-effective fleet capitalization strategy beginning in FY 1993***
- ***NOAA should identify trade-offs between new-vessel performance and costs, taking into account life-cycle, cost-estimating techniques. NOAA should also develop explicit decision criteria for use in a decision tree based upon the simplified model shown in Figure 5-1***
- ***Depending upon program priority and budget availability decisions by policymakers in future years, the fleet capitalization strategies that should be initially given the most favorable consideration are in the range of "Planning Level A/B" discussed above. This would result in a future NOAA fleet ranging from 22 to 33 vessels. Later decisions should be made annually thereafter***

Figure 5-1. *A simplified version of the decision tree model developed from explicit decision criteria.*



- ***NOAA should establish a fleet modernization program office to perform strategic planning and technical analysis to support policy decision-making by NOAA, DOC, OMB, and the Congress. Once the modernization begins, the office would perform ongoing management functions***

- ***NOAA should establish and maintain a policy of coordination with other vessel operators in this country and abroad to respond most cost-effectively to the urgent marine and atmospheric problems on the national agenda***

- ***Whenever feasible, consideration should be given to coordinating ship design and construction plans with other federal organizations (i.e., National Science Foundation and the Navy) in order to reduce development costs***

- ***NOAA should be a model manager and operator of an oceanographic fleet both at home and abroad***

Glossary

AOML	Atlantic Oceanographic and Meteorological Laboratory (NOAA)
CCF	Capital Construction Fund
CH_4	Methane
CO	Carbon Monoxide
CO_2	Carbon Dioxide
DAS	Days at Sea
DOC	Department of Commerce
EEZ	Exclusive Economic Zone
EMAP	Environmental Monitoring and Assessment Program
Eos or EOS	Earth Observing System
EPA	Environmental Protection Agency
EPOCS	Equatorial Pacific Ocean Climate Studies
FMP	Fishery Management Plan
FOCI	Fisheries Oceanography Coordinated Investigations
GFDL	Geophysical Fluid Dynamics Laboratory (NOAA)
GFE	Government–Furnished Equipment
GPS	Global Positioning System
IFREMER	Institut Français de Recherche pour l'Exploitation de la Mer
IHO	International Hydrographic Organization
LMR	Living Marine Resources
NECOP	Nutrient Enhanced Coastal Ocean Productivity
NMFS	National Marine Fisheries Service (NOAA)
NMHC	Non–Methane Hydrocarbon
NOAA	National Oceanic and Atmospheric Administration (DOC)
NOS	National Ocean Service (NOAA)
NS&T	National Status and Trends Program
NWS	National Weather Service (NOAA)
O_3	Ozone
OAR	Office of Oceanic and Atmospheric Research (NOAA)
OCS	Outer Continental Shelf
OCSEAP	Outer Continental Shelf Environmental Assessment Program
OMB	Office of Management and Budget
PMEL	Pacific Marine Environmental Laboratory (NOAA)
RFI	Request for Information
RITS	Radiatively Important Trace Species
STACS	Subtropical Atlantic Climate Studies
SURF	Survey Users Request File
TOGA	Tropical Ocean and Global Atmosphere program
UNOLS	University National Oceanographic Laboratory System

USGS	United States Geological Survey (DOI)
VENTS	Name of hydrothermal venting research program (not an acronym).
WOCE	World Ocean Circulation Experiment

Appendix A

Preliminary Strategies for Fleet Replacement

Overview

A number of strategies have been developed for Phase III of the fleet modernization study to make the transition of the NOAA fleet from its current state to new levels of capability. Included in these strategies is an assessment of continuing to operate the fleet without the benefit of a modernization program. Information contained in this document was prepared for discussion purposes and is not intended to represent a detailed or final analysis of the options.

Days–at–sea (DAS) requirements were provided at four levels: Current (3600), Planning Level A (6100), Planning Level B (7910) and Planning Level C (10,215) for High–Endurance, Medium–Endurance, Coastal/Low–Endurance and Nearshore/Estuarine ship capabilities. Fleet size was determined using 240 DAS per ship for all vessels except in some options 300 DAS were used for the high– and medium–endurance vessels. The fleet size ranges from 18 vessels at the current level to 43 vessels at the Planning Level C and the respective 15–year cost range from $332 million to $1,918 million.

Included in the strategies are service–life extension, new construction, and chartering options. Two chartering models were utilized in developing the costs. One model assumes that a limited number of contract vessels are currently available to meet the program requirements, and these vessels are used to supplement the new construction program. For the replacement of the entire fleet by charter/contract, it was assumed that the contractor must build new ships to meet these program requirements.

A cost summary for each replacement option is included. Scheduling of new construction, service–life extension, and chartering vary with each option. Phased replacement of ships based on material condition and functionality, leveling of costs for the 15–year period, and increasing DAS were generally optimized for each option. This optimization affects the cost for each option and may not reflect NOAA program priorities. A 30–year cost and comparison of the Planning Level A new construction versus chartering options was developed. As indicated by this comparison, the 15–year cost does not provide an adequate view of the total 30–year life–cycle cost of operating the fleet. Thirty–year life–cycle costs should be developed for the options selected for further consideration in the fleet modernization program.

Purpose/Assumptions

Purpose of Study

Provide background information and "first cut" strategies for NOAA fleet replacement, and to show the impact of no new funding.

Assumptions of Study

Replacement program is to start in Fiscal Year 1993.

Estimated costs are in 1990 dollars.

Phased replacement of vessels in approximately 15-year period is based on material condition and functionality.

Suitable vessels are service-life extended or repaired to make transition to new fleet.

Costs generally are leveled for the 15-year period.

Increasing DAS early in the plans was a high priority.

Existing shore-based facilities and logistics support are adequate for the Current and Planning Level A ship requirements.

Expanded shore facilities and logistics support will be required for the Planning Level B and Planning Level C ship requirements but these costs are not included in the options presented.

Replacement of 9 vessels in the 40-65' range operated by the program areas is not included in preliminary strategies. Costs of replacing and outfitting these vessels are estimated to range from $10-$20 million. Replacement of these vessels should be included in the fleet modernization plan.

Requirements

Requirements are defined in days–at–sea (DAS) at four levels by program area:

Current	Planning Level B
Planning Level A	Planning Level C

Capability of vessels to meet these requirements are defined in four classes:

High Endurance	Coastal/Low Endurance
Medium Endurance	Nearshore/Estuarine

Number of ships is determined by defining a ship year as 240 DAS or 300 DAS.

DAS REQUIREMENTS

LEVEL	CHARTING	LMR	OCEANOGRAPHY	TOTAL
Current	1,100	1,540	960	3,600
Planning Level A	2,160	2,470	1,470	6,100
Planning Level B	2,640	3,460	1,810	7,910
Planning Level C	3,610	4,570	2,035	10,215

SHIP REQUIREMENTS
240 DAS PER SHIP
( ) Number of Ships Suitable for Charter/Contract

LEVEL	CHARTING	LMR	OCEANOGRAPHY	TOTAL
Current	6.0	7.7	4.3	18.0*
Planning Level A	9.0 (1.0)	10.0 (1.0)	6.0	25.0 (2.0)
Planning Level B	11.0 (3.0)	14.5 (3.0)	7.5 (1.0)	33.0 (7.0)
Planning Level C	15.0 (3.0)	19.0 (3.0)	9.0 (1.0)	43.0 (7.0)

* DAS vary from 140 to 240

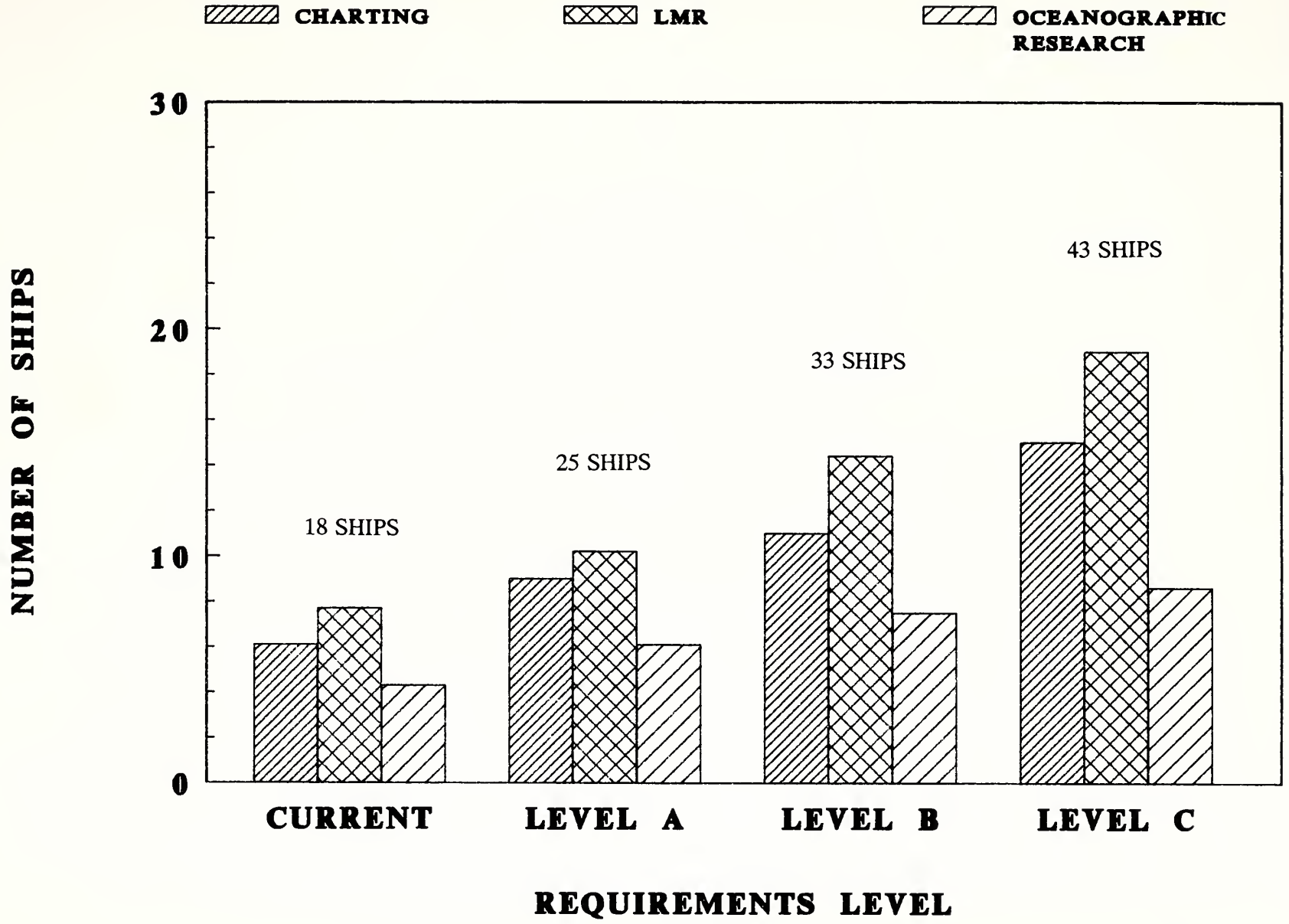
SHIP REQUIREMENTS
300 DAS PER SHIP
HIGH- AND MEDIUM-ENDURANCE VESSELS

LEVEL	CHARTING	LMR	OCEANOGRAPHY	TOTAL
Planning Level A	8.0	10.0	5.0	23.0
Planning Level B	10.0	14.0	7.0	31.0

PHASE III - FLEET REQUIREMENTS STUDY
NOAA FLEET REQUIREMENTS IN DAYS-AT-SEA BY PROGRAM MISSION

VESSEL TYPE AND PROGRAM MISSION	DAYS-AT-SEA (DAS)			
	CURRENT	*PLANNING LEVEL A*	*PLANNING LEVEL B*	*PLANNING LEVEL C*
HIGH ENDURANCE				
CHARTING	140	240	240	240
LIVING MARINE RESOURCES	120	150	200	180
OCEANOGRAPHY	280	475	555	695
TOTAL	**540**	**865**	**995**	**1115**
MEDIUM ENDURANCE				
CHARTING	385	720	960	1200
LIVING MARINE RESOURCES	219	500	480	720
OCEANOGRAPHY	154	250	255	310
TOTAL	**758**	**1470**	**1695**	**2230**
LOW ENDURANCE				
CHARTING	220	720	960	1200
LIVING MARINE RESOURCES	1261	1610	2310	2700
OCEANOGRAPHY	0	85	285	325
TOTAL	**1481**	**2415**	**3555**	**4225**
NEARSHORE/ESTUARINE				
CHARTING	360	480	480	960
LIVING MARINE RESOURCES	140	210	480	960
OCEANOGRAPHY	321	660	705	725
TOTAL	**821**	**1350**	**1665**	**2645**
TOTALS				
CHARTING	1105	2160	2640	3600
LIVING MARINE RESOURCES	1740	2470	3470	4560
OCEANOGRAPHY	755	1470	1800	2055
GRAND TOTAL	**3600**	**6100**	**7910**	**10215**

PHASE III SHIP REQUIREMENTS: TYPE OF MISSION



Notes:

Vessel Classification and Costs

New ships are defined in four classes of capability to meet requirements for oceanography, living marine resources, and charting:

High Endurance	Low Endurance
Medium Endurance	Nearshore/Estuarine

Summary and detailed ship replacement costs for the design, construction, and mission outfitting were developed in Phase II of the Fleet Modernization Study.

HIGH ENDURANCE

VESSEL CAPABILITY	CHARTING	LMR	OCEANOGRAPHY
Cruising speed (knots)	15	15	15
Range (nm)	14,400	12,000	15,000
Endurance (days)	40-60	45	60
Accommodations (no.)	30	20	35
Ice strengthening (ABS Class)	C	C	1A
Deck working area (sq. ft.)	2,000	2,000	7,000
Cranes/A-frames/gantry (no.)	2/1/1	2/2/1	4/2/1
Winches (no.)	2	5	4
Laboratory area (sq. ft.)	1,400	2,000	3,700
Vans (no.)	4	4	8
Scientific storage (cu. ft.)	5,000	10,000	16,000
Trawlway	no	yes	yes
Launches	1	1	3

MEDIUM ENDURANCE

VESSEL CAPABILITY	CHARTING	LMR	OCEANOGRAPHY
Cruising speed (knots)	13	13	13
Range (nm)	8,000	8,000	8,000
Endurance (days)	25	30	45
Accommodations (no.)	30	16	25
Ice strengthening (ABS Class)	C	C	1A
Deck working area (sq. ft.)	2,000	1,500	4,000
Cranes/A-frames/gantry (no.)	1/2/1	2/2/1	3/2/1
Winches (no.)	2	5	3
Laboratory area (sq. ft.)	1,500	1,500	2,400
Vans (no.)	2	2	6
Scientific storage (cu. ft.)	3,000	7,000	10,000
Trawlway	no	yes	yes
Launches	4	1	2 rib

COASTAL/LOW ENDURANCE

VESSEL CAPABILITY	CHARTING	LMR	OCEANOGRAPHY
Cruising speed (knots)	12	12	12
Range (nm)	5,800	5,000	5,000
Endurance (days)	20	21	21
Accommodations (no.)	22	12	16
Ice strengthening (ABS Class)	C	C	C
Deck working area (sq. ft.)	2,000	1,000	1,700
Cranes/A-frames/gantry (no.)	2/2/1	2/2/1	2/1/1
Winches (no.)	2	5	2
Laboratory area (sq. ft.)	1,500	1,000	1,000
Vans (no.)	1	1	2
Scientific storage (cu. ft.)	3,000	5,000	5,000
Trawlway	no	yes	yes
Launches	2	1	2

NEARSHORE/ESTUARINE

VESSEL CAPABILITY	CHARTING	LMR	OCEANOGRAPHY
Cruising speed (knots)	10	10	10
Range (nm)	2,900	2,000	2,500
Endurance (days)	10	10	10
Accommodations (no.)	10	8	8
Ice strengthening (ABS Class)	–	–	–
Deck working area (sq. ft.)	500	600	600
Cranes/A-frames/gantry (no.)	1/1/1	1/1/1	2/1/1
Winches (no.)	2	3	3
Laboratory area (sq. ft.)	700	500	500
Vans (no.)	1	1	1
Scientific storage (cu. ft.)	1,500	2,000	2,000
Trawlway	no	yes	yes
Launches	1	1	1

NUMBER AND MIX OF SHIPS

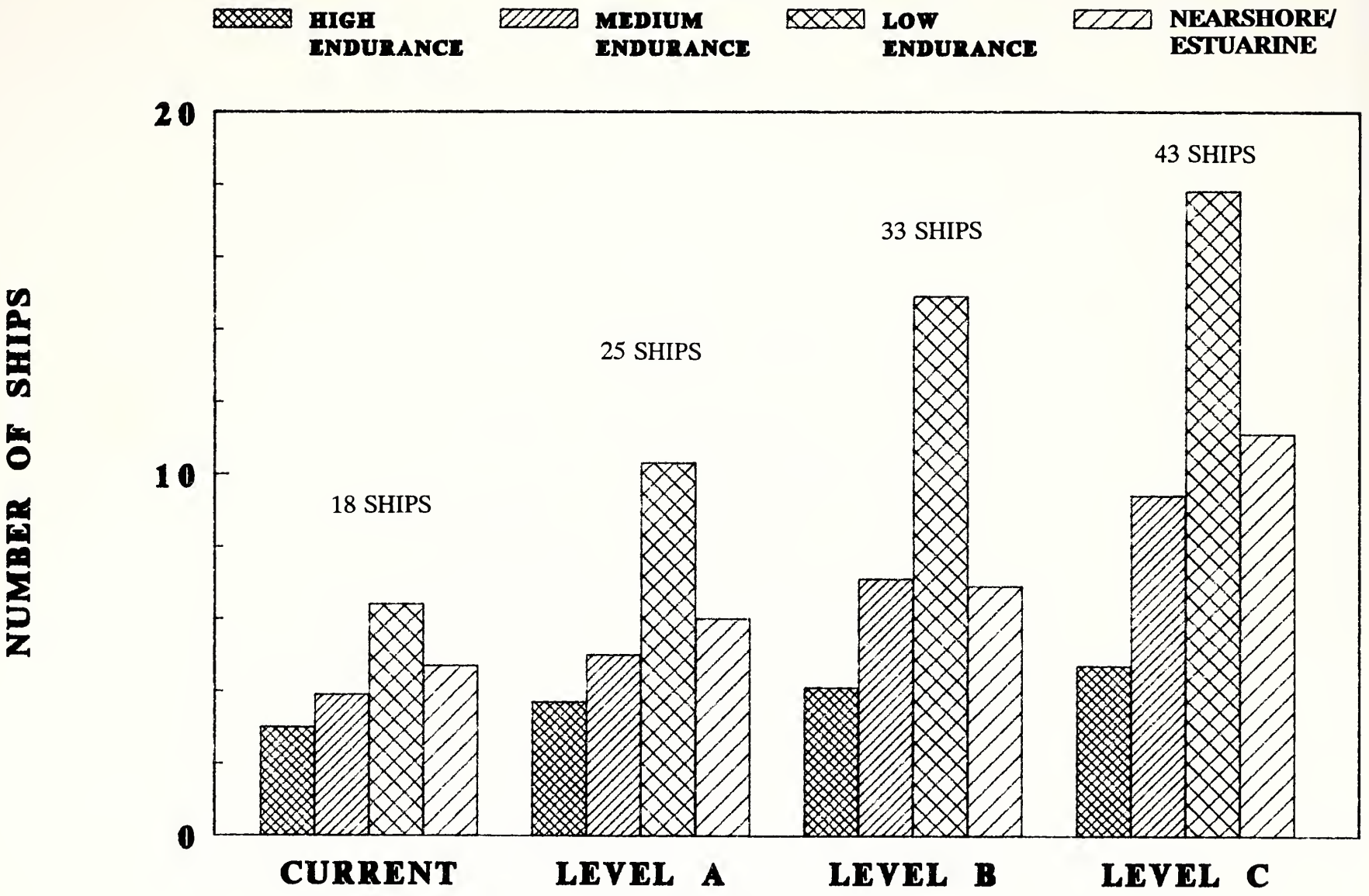
	CURRENT	PLANNING LEVEL A	PLANNING LEVEL B	PLANNING LEVEL C
High Endurance	3.0	3.7	4.1	4.7
Medium Endurance	3.9	5.0	7.1	9.4
Coastal/Low Endurance	6.4	10.3	14.9	17.8
Nearshore/Estuarine	4.7	6.0	6.9	11.1
TOTAL	**18.0**	**25.0**	**33.0**	**43.0**

SHIP REPLACEMENT COST SUMMARY ($M)*

	CHARTING	LMR	OCEANOGRAPHY
High Endurance	43	42	53
Medium Endurance	41	42	44
Coastal/Low Endurance	29	23	28
Nearshore/Estuarine	15	9	13

* Estimates derived by using an average of the min/max costs with mission gear plus the design costs (see accompanying table on p. A16)

PHASE III SHIP REQUIREMENTS: TYPE OF VESSEL



SHIP REPLACEMENT
COST BREAKDOWN ($M)

	Construction Contract Cost		Mission Outfit	Cost with Mission Gear		Design	Change Order	Commission'g	Totals	
	Min	Max		Min	Max				Min	Max
High Endurance										
Charting	27.8	35.3	10.7	36.6	46.0	2.2	3.2	2.0	45.9	53.4
LMR	26.1	33.2	10.6	34.5	43.8	2.1	3.0	2.0	43.7	50.8
Oceanography	35.0	43.6	11.7	44.9	55.3	2.8	3.9	2.0	55.4	64.0
Medium Endurance										
Charting	25.8	32.7	10.4	33.9	43.1	2.0	2.9	1.5	42.7	49.6
LMR	26.5	33.7	10.3	34.9	44.0	2.1	3.0	1.5	43.4	50.6
Oceanography	27.8	35.1	11.0	36.6	46.1	2.2	3.1	1.5	45.6	52.9
Low Endurance										
Charting	17.3	22.9	8.6	23.5	31.5	1.4	2.0	1.0	30.3	35.9
LMR	13.3	18.2	7.3	18.7	25.5	1.1	1.6	1.0	24.3	29.2
Oceanography	16.4	21.9	8.1	22.6	30.0	1.3	1.9	1.0	28.8	34.3
Nearshore/Estuarine										
Charting	7.6	11.0	5.6	11.0	16.6	0.7	0.9	0.5	15.3	18.7
LMR	4.3	6.7	3.9	6.6	10.6	0.4	0.6	0.5	9.6	12.0
Oceanography	6.7	9.6	5.3	10.0	14.9	0.6	0.8	0.5	13.9	16.8

Charter/Contract Ship Support Requirements

Charter of Existing Ships

Assumes existing ships which meet NOAA requirements are available for charter.

Ship support requirements suitable for charter/contract have been identified in the Planning Level A, Planning Level B, and Planning Level C requirements levels by the program areas.

Preliminary costs (not verified) for the four classes of ships have been derived for estimating purposes only. These costs include all operating costs except scientific support.

Ships chartered/contracted are equivalent in capability and equipment to those defined by requirements.

Transition plans have been modified to identified charter/contract ships.

Replacement schedules have not been readjusted.

Charter/contract is assumed to start in Fiscal Year 93 for all ships and cost estimates adjusted accordingly.

AMOUNT OF SHIP SUPPORT SUITABLE FOR CHARTER/CONTRACT

LEVEL	CHARTING	LMR	OCEANOGRAPHY	TOTAL
Current	–	–	–	–
Planning Level A	1 HE	1 HE	–	2 HE
Planning Level B	1 HE	1 HE	–	2 HE
	1 ME	1 ME	–	2 ME
	1 LE	1 LE	1 LE	3 LE
Planning Level C	1 HE	1 HE	–	2 HE
	1 ME	1 ME	–	2 ME
	1 LE	1 LE	1 LE	3 LE

HE – High Endurance ME – Medium Endurance LE – Low Endurance

PRELIMINARY CHARTER/CONTRACT COST ESTIMATES FOR EXISTING SHIPS BASED ON 240 DAS

CLASS	COST ($M)	AVERAGE COST ($M)
High Endurance	4.0 – 6.0	5.0
Medium Endurance	3.0 – 5.0	4.0
Low Endurance	2.0 – 3.0	2.5
Nearshore/Estuarine	1.0 – 2.0	1.5

Chartering of New Construction to Replace Current Fleet Assumptions

A more detailed cost analysis and a survey of the market will be required to refine the chartering model.

Ships chartered/contracted are equivalent in capability and equipment to those defined by requirements.

Construction of vessels by contractor will be necessary to meet the NOAA requirements.

Charter vessel options are:
Operating Crew – Contractor
Scientific Crew – NOAA.

Cost estimated with 20–year loans at 10% interest for ship construction.

Scientific instrument suite and mission outfitting to be government–furnished equipment.

Current NOAA fleet replaced with charter vessels within two years of projected remaining service life.

Chartering costs are government–projected estimates.

Chartered Vessel Cost Assumptions

Crew size is 21 for high–endurance, 18 for medium–endurance, 15 for coastal/estuarine, and 12 for nearshore vessels.

Mission personnel costs were derived by using a percentage of the current NOAA vessel crewing cost consistent with the mission.

Current marine center and headquarters functions associated with vessel operations are reduced.

Marine insurance is based on a rate of $.90 per $100.00 of value.

Maintenance costs are 30% of operating costs.

Annual fuel consumption is based on operating at cruising speed for 180 of 240 DAS.

CHARTERED MODEL ESTIMATES ($M)

	Construction Cost	Annual Payment 20 yrs at 10%	Annual Operating Cost	Annual Charter Cost
High Endurance	38	4.5	4.5	9.0
Medium Endurance	33	3.9	3.5	7.4
Coastal/Low Endurance	19	2.2	2.5	4.7
Nearshore/Estuarine	9	1.1	1.4	2.4

NOTES: 1. Average of charting, LMR, and oceanography vessels; does not include mission equipment, change orders, or commissioning
2. See following table for details

CHARTERED VESSEL COST (240 DAS)

(Cost in $1,000 per year)

OPERATING COST	HIGH	MEDIUM	COASTAL	NEARSHORE
Crewing	900	800	600	300
OT at 20%	180	160	120	90
Overhead at 20%	216	192	144	72
Travel	40	36	30	20
Rations	150	90	75	60
Port Fees	25	15	10	10
Shore Support	216	192	144	72
SUBTOTAL	**1727**	**1485**	**1123**	**624**
Insurance	360	360	200	90
Ship Maintenance	600	400	300	200
SUBTOTAL	**2687**	**2245**	**1623**	**914**
G&A at 20% Subtotal	537	449	325	183
SUBTOTAL	**3224**	**2694**	**1948**	**1097**
Profit at 10%	322	269	195	110
Fuel/Expendables	1000	500	350	175
TOTAL	**4546**	**3463**	**2493**	**1382**

Impact of Operating Vessels at Current Level of Maintenance

Background

Outstanding funding issues for 18 active ships are:

- $40 million backlog of critical maintenance items in ship systems
- $50 million replacement of obsolete instrumentation.

Four ships were temporarily removed from service in 1989 to help offset operating and maintenance costs on remaining ships.

Material condition of 18 active ships is:

Poor	3
Fair	9
Good	6.

Assumptions

No service-life extensions will be made.

No increase in maintenance funds; these are adjusted annually for inflation.

Backlog of critical maintenance items will increase for the next few years.

Based on material condition, the following remaining service life of vessels is expected/projected:

Poor	0 – 4 years
Fair	3 – 7 years
Good	6 – 10 years.

Factors that govern the remaining service life are:

Safety	Functionality
Material condition	Age
Qualified operating crew	Availability of spare parts.

Life expectancy is 30 years.

Impacts

Probability is high that by the turn of the century only a few ships will remain in service.

Increase in lost DAS due to safety, unscheduled maintenance, and qualified operating crews is:

YEAR	DAS
FY 88	41
FY 89	185
FY 90	33.

Further degradation in the ability to support NOAA missions/programs will occur.

Definition of Assessment Terms

TERM	MATERIAL CONDITION	FUNCTIONALITY
Good	Major systems are expected to operate reliably provided they receive scheduled maintenance and repair.	Meets majority of the program requirements. Platform is designed and well suited for mission.
Fair	Normal degradation/deterioration due to age. Major systems can be upgraded/overhauled/replaced to provide reliable extended service.	Meets some of the program requirements. Deficiencies can be corrected. In some cases platform not well suited for mission.
Poor	Accelerated degradation/deterioration due to age or technology; or most major systems are obsolete, not expected to provide reliable service; or not cost effective to upgrade.	Major deficiencies in meeting program requirements.

PROJECTED REMAINING YEARS OF SERVICE AT CURRENT LEVEL OF MAINTENANCE/REPAIR WITHOUT SERVICE–LIFE EXTENSIONS

SHIP	PRIMARY MISSION	MATERIAL CONDITION	FUNCTIONALITY	CURRENT AGE (years)	PROJECTED REMAINING YEARS OF SERVICE
Oceanographer	O&AR	fair	fair	24	none
Discoverer	O&AR C&M	fair good	fair good	24	6 – 10
Baldrige	O&AR	fair	fair	20	3 – 7
Surveyor	O&AR C&M FR	poor	poor good poor	30	0 – 4
Fairweather	C&M	good	good	22	6 – 10
Rainier	O&AR C&M	good	good good	22	6 – 10
Mt. Mitchell	C&M	fair	good	21	3 – 7
Miller Freeman	O&AR C&M FR	fair	good good good	22	3 – 7
Peirce	C&M	good	fair	27	6 – 10
Whiting	C&M	good	good	27	6 – 10
McArthur	EA	fair	fair	24	3 – 7
Davidson	C&M	good	fair	23	6 – 10
Oregon II	FR	fair	poor	23	3 – 7
Albatross IV	FR	poor	good	28	none
Cromwell	FR	poor	poor	27	0 – 4

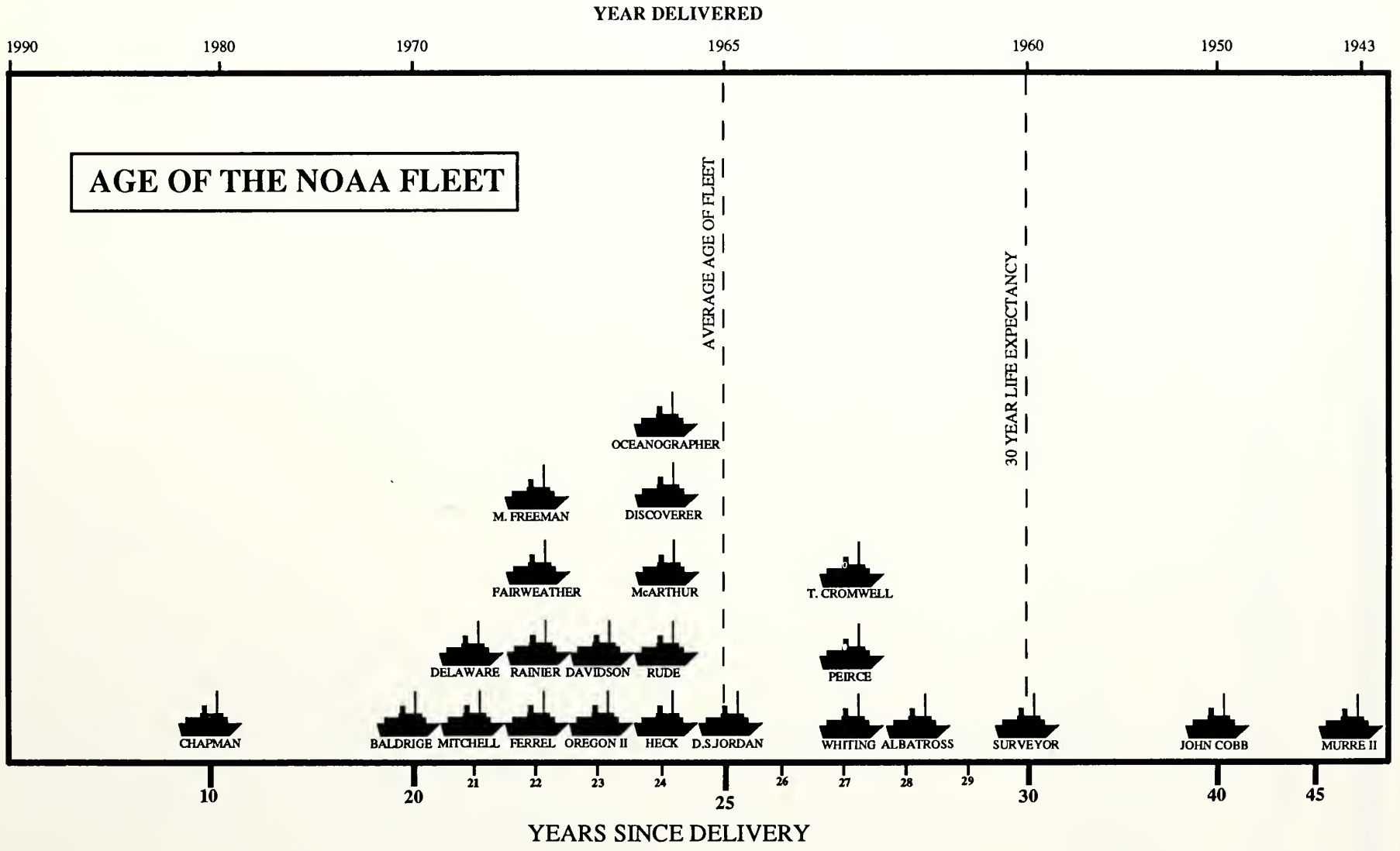
PROJECTED REMAINING YEARS OF SERVICE AT CURRENT LEVEL OF MAINTENANCE/REPAIR WITHOUT SERVICE-LIFE EXTENSIONS
(continued)

SHIP	PRIMARY MISSION	MATERIAL CONDITION	FUNCTIONALITY	CURRENT AGE (years)	PROJECTED REMAINING YEARS OF SERVICE
Jordan	FR	fair	fair	25	3 – 7
Delaware II	FR	good	good	21	6 – 10
Chapman	FR	fair	good	10	3 – 7
Ferrel	EA	fair	good	22	3 – 7
John N. Cobb	FR	poor	fair	40	0 – 4
Rude	C&M	fair	poor	24	3 – 7
Heck	C&M	fair	poor	24	3 – 7
Murre II	FR	poor	fair	46	0 – 4

O&AR – Oceanic and Atmospheric Research
C&M – Charting and Mapping
FR – Fisheries Research

Key to Abbreviations for Ships of the NOAA Fleet

ABBREVIATION	SHIP
OC	OCEANOGRAPHER
DI	DISCOVERER
MB	MALCOLM BALDRIGE
SU	SURVEYOR
FA	FAIRWEATHER
RA	RAINIER
MI	MT. MITCHELL
MF	MILLER FREEMAN
PE	PEIRCE
WH	WHITING
AR	McARTHUR
DA	DAVIDSON
OR	OREGON II
AL	ALBATROSS IV
TC	TOWNSEND CROMWELL
JO	DAVID STARR JORDAN
DE	DELAWARE II
CH	CHAPMAN
FE	FERREL
JC	JOHN N. COBB
RU	RUDE
HE	HECK
MU	MURRE II

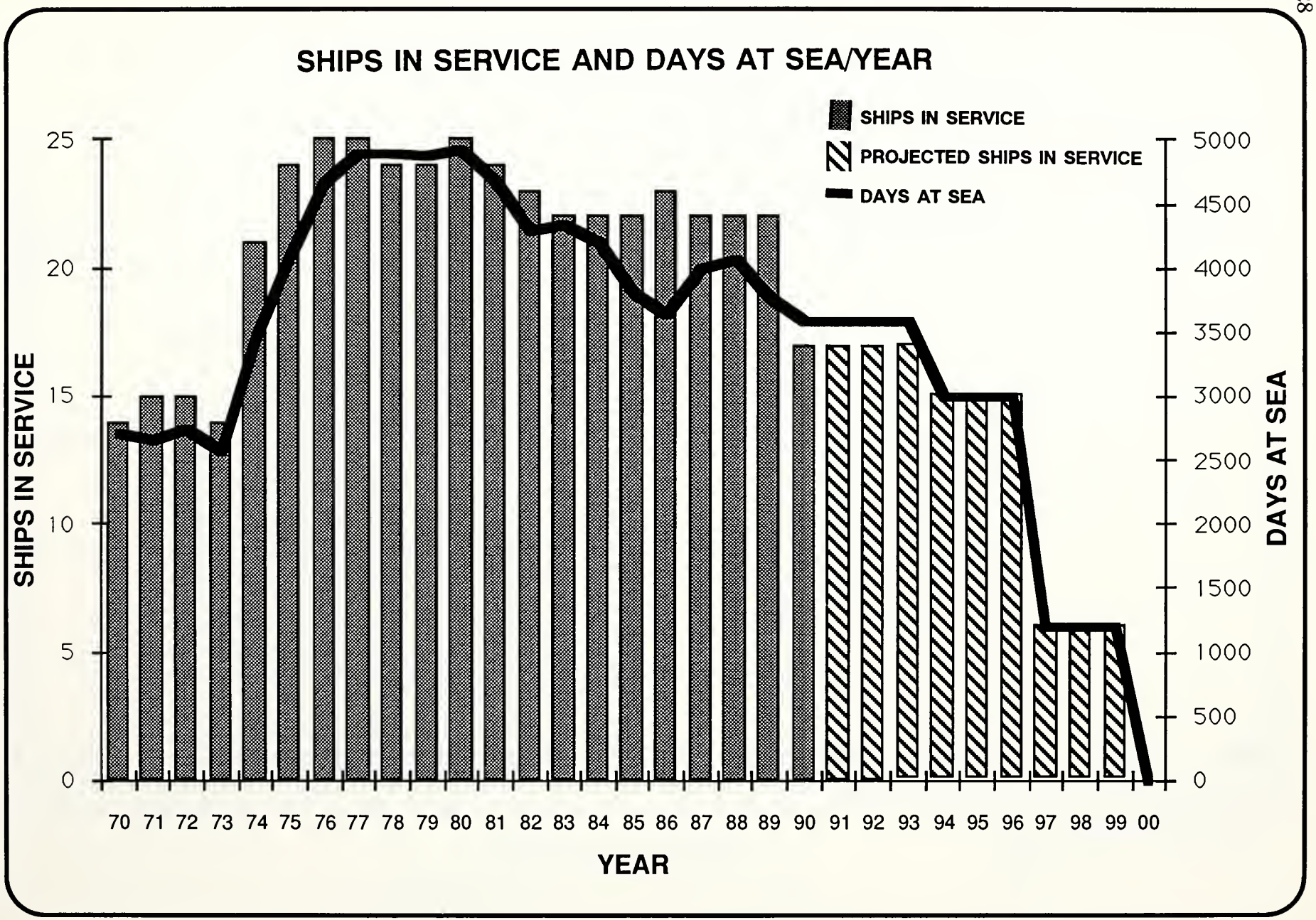

YEAR DELIVERED
1990
1980
1970
1965
1960
1950
1943
AGE OF THE NOAA FLEET
AVERAGE AGE OF FLEET
30 YEAR LIFE EXPECTANCY
OCEANOGRAPHER
M. FREEMAN
DISCOVERER
FAIRWEATHER
McARTHUR
T. CROMWELL
DELAWARE
RAINIER
DAVIDSON
RUDE
PEIRCE
CHAPMAN
BALDRIGE
MITCHELL
FERREL
OREGON II
HECK
D.S.JORDAN
WHITING
ALBATROSS
SURVEYOR
JOHN COBB
MURRE II
10
20
21
22
23
24
25
26
27
28
29
30
40
45
YEARS SINCE DELIVERY

PROJECTED SERVICE LIFE OF CURRENT NOAA FLEET AT CURRENT MAINTENANCE LEVEL*

	SHIP	FY'92	FY'93	FY'94	FY'95	FY'96	FY'97	FY'98	FY'99	FY'00	FY'01	FY'02	FY'03	FY'04	FY'05	FY'06
CLASS I	OC	INACTIVE	26 **													
	DI										34					
	MB							27								
	SU			34												
CLASS II	FA	INACTIVE	24													
	RA										32					
	MI							28								
	MF							29								
CLASS III	PE	INACTIVE	29													
	WH										37					
	AR							31								
	DA										33					
	OR							30								
	AL	INACTIVE	30													
CLASS IV	TC			31												
	JO							32								
	DE										31					
	CH										20					
	FE							29								
CLASS V	JC			44												
	RU							31								
	HE							31								
CLASS VI	MU	INACTIVE	47													
NUMBER OF OPERATING SHIPS			18			15			6							

* KEY TO SHIP ABBREVIATIONS APPEARS ON P. A25.

** SHIPS' AGE AT DEACTIVATION ARE SHOWN AFTER BARS.


SHIPS IN SERVICE AND DAYS AT SEA/YEAR
SHIPS IN SERVICE
PROJECTED SHIPS IN SERVICE
DAYS AT SEA
SHIPS IN SERVICE
DAYS AT SEA
0
5
10
15
20
25
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 00
YEAR

Current Level

Construct 6, Service-Life Extend 12
Construct 18
Charter 18

Current Level - Construct 6, Service-Life Extend 12

Preliminary Transition Plan

18-ship operating fleet consists of:
6 ships - replaced
12 ships - service-life extended.

FAIRWEATHER and a LMR conversion would be utilized as "swing ships" to maintain the DAS during service-life extension.

Ship operations are increased to 240 DAS upon completion of service-life extension or replacement. Operating costs are increased accordingly.

Service-life extension and replacements are completed in 7 years.

Estimated cost is $332 million.

Total DAS is increased from 3600 to 4320 by fiscal year 2000.

Service-life extension adds approximately 15 years to operating life of the vessel. Replacement program must begin no later than Fiscal Year 2008.

Construction and service-life extension periods do not include time for design, specifications development, or contract award.

*Transition Plan Highlights**

PHASE I
FY 1993 – FY 1997

1 ship reactivated (FA)
1 ship conversion (LMR)
9 ships service-life extended (DI, MB, RA, MI, MF, WH, DS, DE, FE)
5 ships replaced (SU, TC, RU, HE, JC)
Construction started on 1 replacement ship (OR)
Ship operations increased from 3600 to 4000 DAS

Cost $246.8M

PHASE II
FY 1998 – FY 2002

4 ships service-life extended (RA, AR, DA, CH)
1 ship replaced (OR)
Ship operations increased from 4000 to 4320 DAS

Cost $59.5M

PHASE III
FY 2003 – 2007

All ships operating at 240 DAS
Planning for fleet replacement to avoid block obsolescence

Cost $25.5M

TOTAL COST **$331.8M**

* Key to Ship Abbreviations appears on p. A25

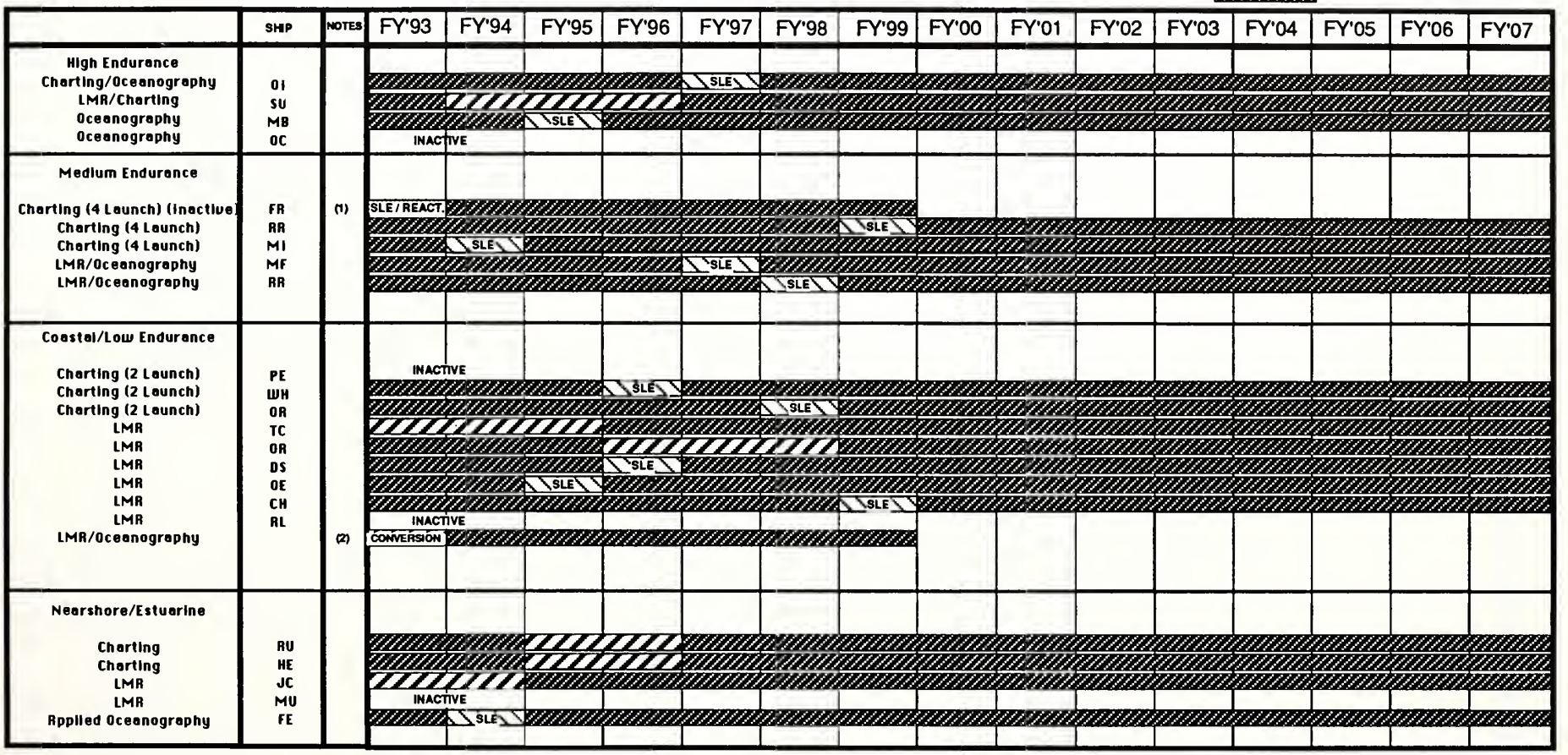
NUMBER AND MIX OF SHIPS
3600 DAS

	CHARTING	LIVING MARINE RESOURCES	OCEANOGRAPHY	TOTAL
High Endurance	0.8	0.6	1.6	3.0
Medium Endurance	2.1	0.9	0.9	3.9
Low Endurance	1.2	5.2	–	6.4
Nearshore/Estuarine	2.0	1.0	1.7	4.7
TOTAL	**6.1**	**7.7**	**4.21**	**18.0**

15–YEAR COST SUMMARY

ACTIVITY	COST ($M)
Service–Life Extension/Conversion – 14 ships	$ 131.0
New Ship Construction – 6 ships	127.0
Support Cost (operating, project, commissioning, change orders)	73.8
15–YEAR TOTAL	**$331.8**

NOAA FLEET
CURRENT LEVEL*



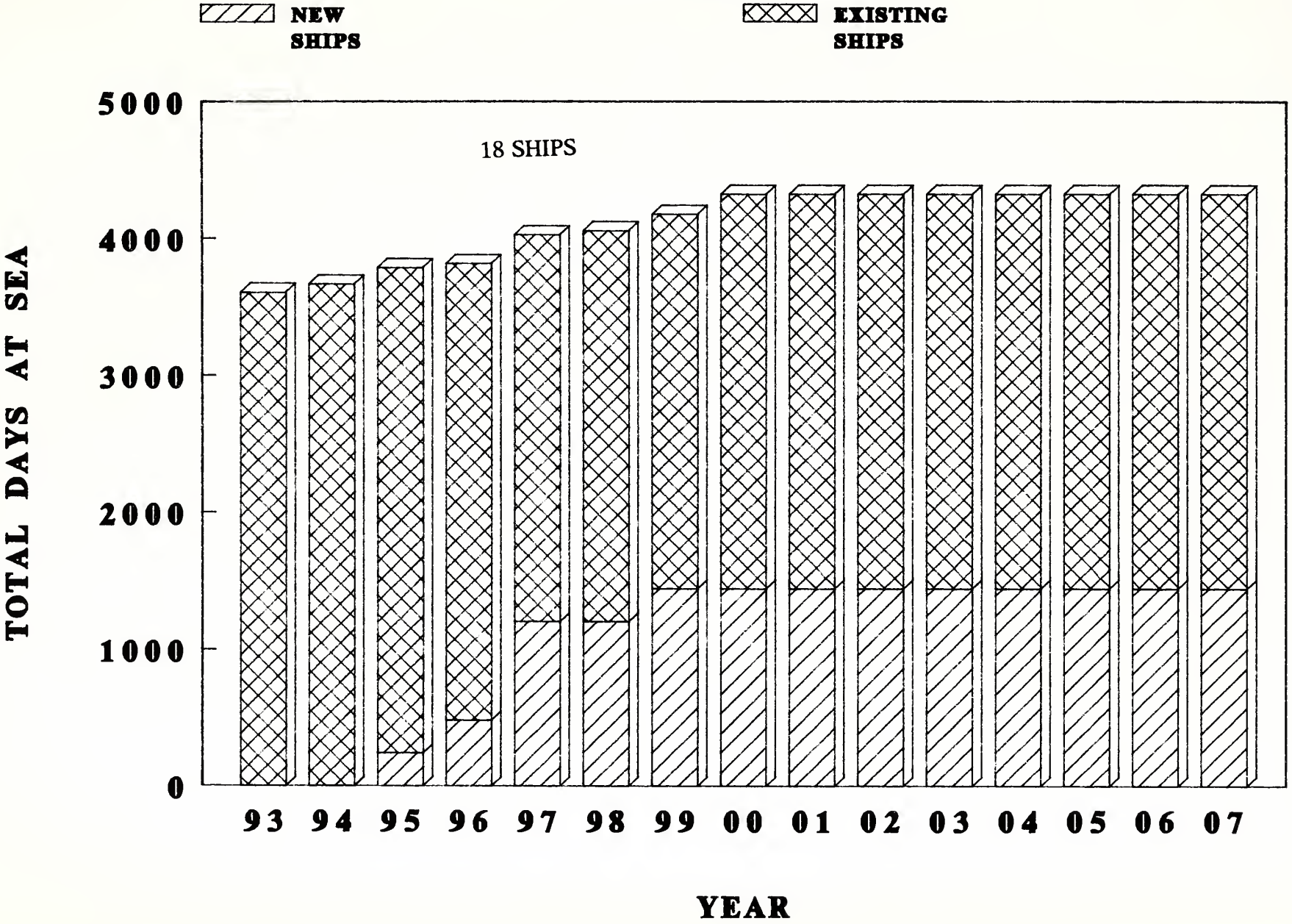
* KEY TO SHIP ABBREVIATIONS APPEARS ON P. A25.

NOTES: (1) FAIRWEATHER REACTIVATED AND SERVES AS "SWING SHIP" DURING SERVICE-LIFE EXTENSION OF SURVEY VESSELS.

(2) CONVERSION SERVES AS "SWING SHIP" DURING SERVICE-LIFE EXTENSION OF LMR VESSELS.

(3) SHIP OPERATIONS INCREASED TO 240 DAS UPON COMPLETION OF SERVICE-LIFE EXTENSION OR REPLACEMENT.

TOTAL FLEET DAYS AT SEA
CURRENT LEVEL



CURRENT LEVEL
COSTS IN 1990 DOLLARS (MILLIONS)

ACTIVITY	FY1993	FY94	FY95	FY96	FY97	FY98	FY99	FY2000	FY01	FY02	FY03	FY04	FY05	FY06	FY07	TOTALS
Service life extension	12.5	12.5	23.5	14.0	23.0	18.0	17.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	121.0
Conversions	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.0
Replacement vessels	32.0	42.0	30.0	23.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	127.0
New requirements	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
New operating costs	0.0	0.6	1.2	1.8	3.0	3.6	4.5	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	55.5
Project costs	0.5	0.5	0.5	0.5	0.3	0.3	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.9
Commissioning/ changing orders	3.8	5.7	3.1	2.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	15.4
TOTAL	**58.8**	**61.3**	**58.3**	**42.1**	**26.3**	**21.9**	**22.3**	**5.1**	**5.1**	**5.1**	**5.1**	**5.1**	**5.1**	**5.1**	**5.1**	**331.8**

GRAND TOTAL $331.8

Current Level – Construct 18

Preliminary Transition Plan

Operating fleet is 18 ships.

All ships are replaced in 15 years.

FAIRWEATHER and ALBATROSS IV are utilized as "swing ships" to maintain the DAS during service–life extension.

Ship operations are increased to 240 DAS upon completion of service–life extension or replacement. Operating cost increased accordingly.

Total DAS are increased from 3600 to 4320 by Fiscal Year 1999.

Construction and repair periods do not include time for design, specifications development, or contract award.

Estimated cost is $736 million, or $49 million per year.

*Transition Plan Highlights**

PHASE I
FY 1993 – FY 1997

2 ships reactivated (FA, AL)
11 ships service–life extended or repaired to extend service life
(DI, MB, AR, DA, MI, MF, WH, DS, DE, CH, RA)
5 ships replaced (SU, TC, RU, HE, JC)
Construction started on 2 replacement ships (OR, DE)
Ship operations increased from 3600 to 4024 DAS

Cost $257.4M

PHASE II
FY 1998 – FY 2002

6 ships replaced (MB, MF, FA, OR, FE, DS)
Construction started on 3 ships (WH, DA, DE)
Ship operations increased from 4024 to 4320 DAS

Cost $287.4M

PHASE III
FY 2003 – FY 2007

All ships operating at 240 DAS
7 ships replaced (DI, RA, AR, CH, WH, DA, DE)

Cost $191.5M

TOTAL COST **$736.3M**

* Key to Ship Abbreviations appears on p. A25

NUMBER AND MIX OF SHIPS
3600 DAS

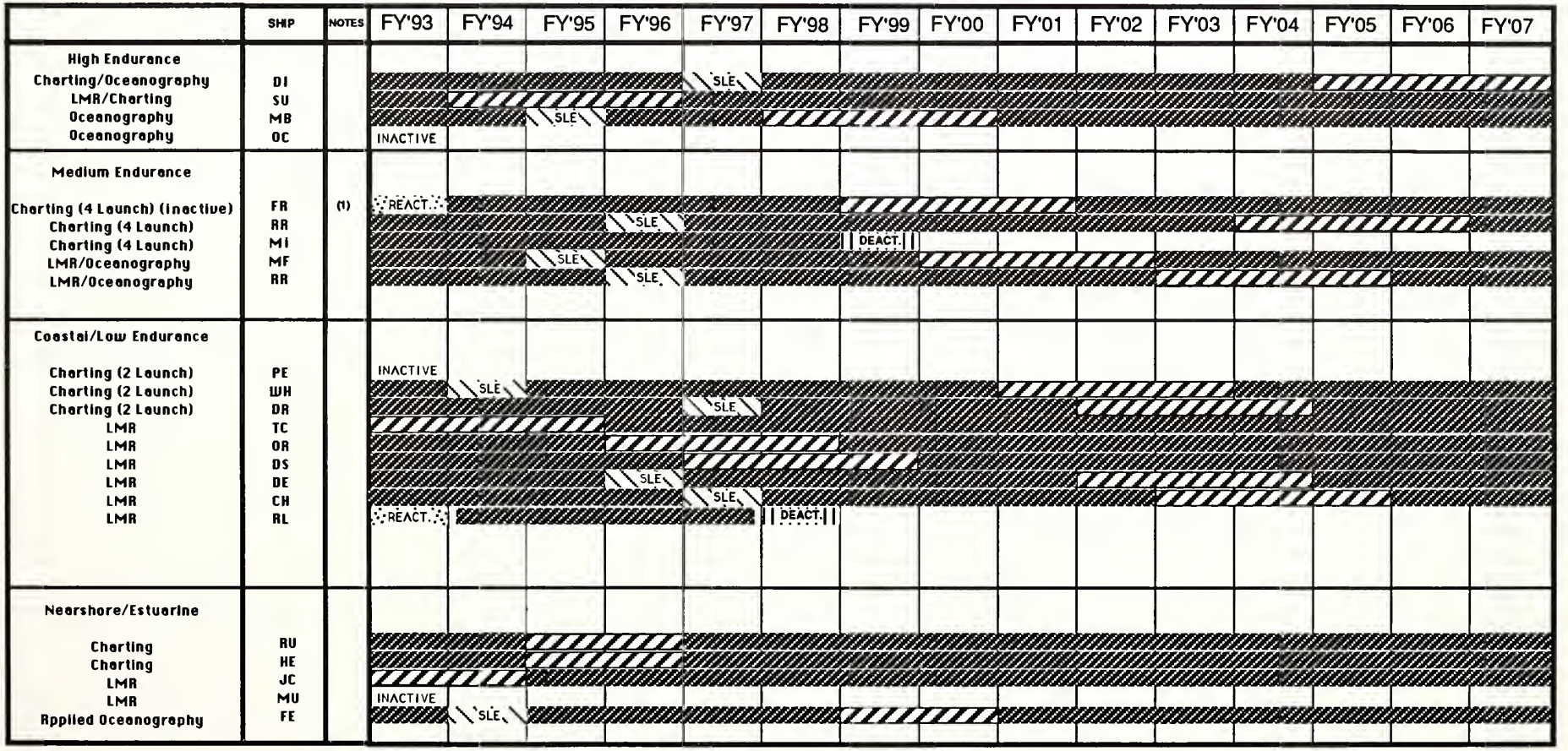
	CHARTING	LIVING MARINE RESOURCES	OCEANOGRAPHY	TOTAL
High Endurance	0.8	0.6	1.6	3.0
Medium Endurance	2.1	0.9	0.9	3.9
Low Endurance	1.2	5.2	–	6.4
Nearshore/Estuarine	2.0	1.0	1.7	4.7
TOTAL	**6.1**	**7.7**	**4.2**	**18.0**

15–YEAR COST SUMMARY

ACTIVITY	COST ($M)
Service–Life Extension/Conversion – 11 ships	$ 63.0
New Ship Construction – 18 ships	526.0
Support Cost (operating, project, commissioning, change orders)	147.3
15–YEAR TOTAL	**$736.3**

NOAA FLEET CURRENT LEVEL REPLACEMENT*

NEW CONSTRUCTION PERIOD
SERVICE-LIFE EXTENSION
ON LINE
REACTIVATE
DEACTIVATE



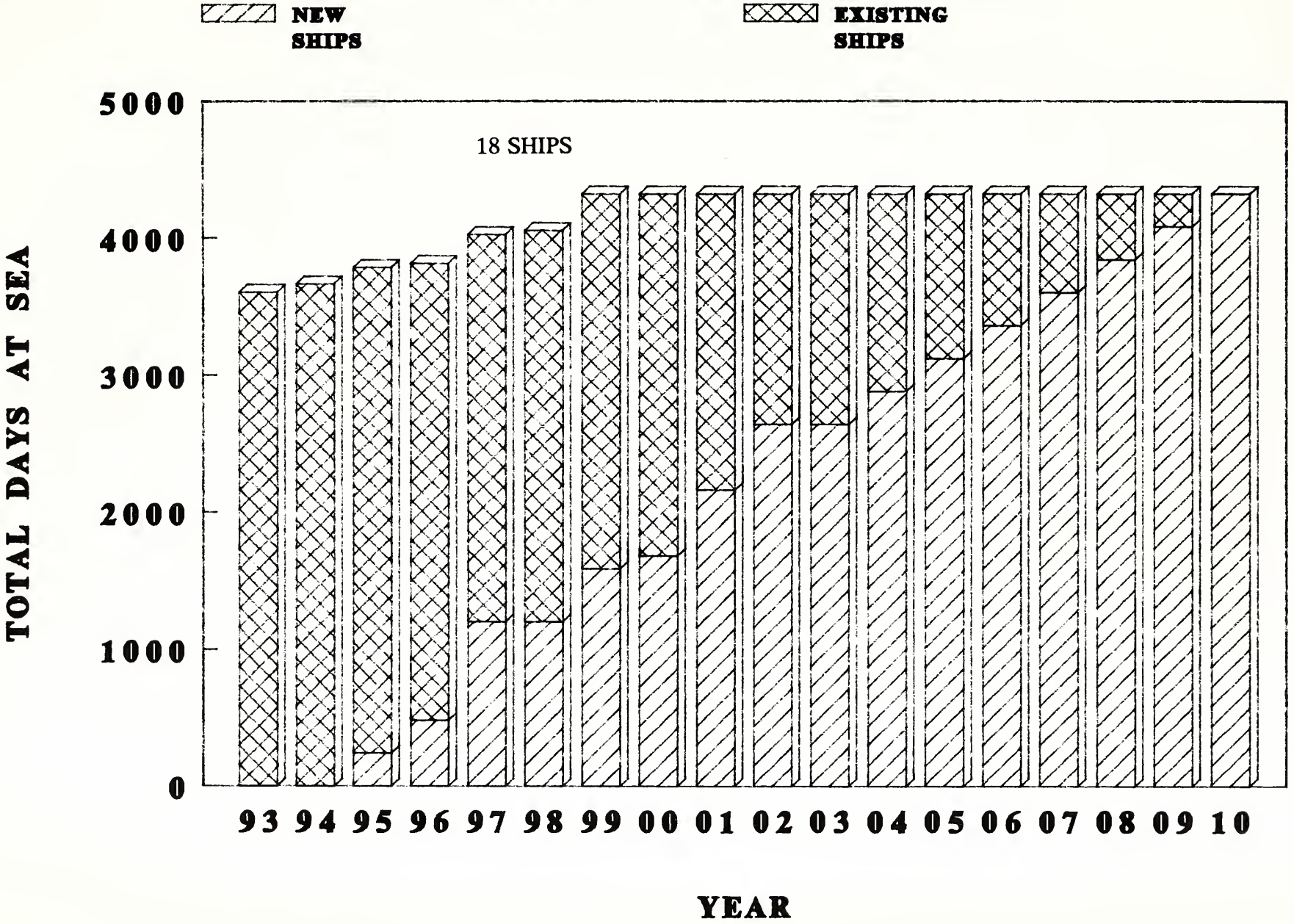
* KEY TO SHIP ABBREVIATIONS APPEARS ON P. A25.

NOTES: (1) FAIRWEATHER REACTIVATED AND SERVES AS "SWING SHIP" DURING SERVICE-LIFE EXTENSION OF SURVEY VESSELS.

(2) CONVERSION SERVES AS "SWING SHIP" DURING SERVICE-LIFE EXTENSION OF LMR VESSELS.

(3) SHIP OPERATIONS INCREASED TO 240 DAS UPON COMPLETION OF SERVICE-LIFE EXTENSION OR REPLACEMENT.

TOTAL FLEET DAYS AT SEA
CURRENT LEVEL REPLACEMENT



CURRENT LEVEL/REPLACE WITH NEW CONSTRUCTION
COSTS IN 1990 DOLLARS (MILLIONS)

ACTIVITY	FY1993	FY94	FY95	FY96	FY97	FY98	FY99	FY2000	FY01	FY02	FY03	FY04	FY05	FY06	FY07	TOTALS
Service life extension	10.0	5.0	13.0	17.0	18.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	63.0
Conversions	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Replacement vessels	32.0	42.0	30.0	23.0	23.0	53.0	41.0	42.0	42.0	52.0	52.0	41.0	53.0	0.0	0.0	526.0
New requirements	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
New operating costs	0.0	1.5	2.7	4.0	4.7	4.9	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	63.7
Project costs	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	0.5	0.5	0.5	0.5	0.5	0.5	0.5	13.1
Commissioning/ changing orders	5.0	5.6	5.2	4.8	4.9	6.4	4.9	5.0	5.0	6.2	6.2	4.9	6.4	0.0	0.0	70.5
TOTAL	**48.2**	**55.3**	**52.1**	**50.0**	**51.8**	**65.5**	**52.2**	**53.3**	**52.6**	**63.8**	**63.8**	**51.5**	**65.0**	**5.6**	**5.6**	**736.3**

GRAND TOTAL $736.3

Current Level – Charter 18

Preliminary Transition Plan

Operating fleet is 18 ships.

All ships are chartered by 1999.

Start of chartering period coincides with predicted remaining service life of existing ships.

Ships are chartered for 240 DAS.

Total DAS are increased to 4320 by 1999.

Assumes existing vessels are not available for charter; therefore, construction cost amortized over 20 years is included in charter cost.

Transition Plan Highlights

PHASE I
FY 1993 – FY 1997

18 existing ships active at start of phase
12 ships chartered
DAS increased from 3600 to 3900

Cost	$251.9M

PHASE II
FY 1998 – FY 2002

All 18 ships chartered
DAS increased from 3900 to 4320

Cost	$309.7M

PHASE III
FY 2003 – FY 2007

All ships chartered at 240 DAS

Cost	$334.0M
TOTAL COST	**$895.6M**

NUMBER AND MIX OF SHIPS
3600 DAS

	CHARTING	LIVING MARINE RESOURCES	OCEANOGRAPHY	TOTAL
High Endurance	0.8	0.6	1.6	3.0
Medium Endurance	2.1	0.9	0.9	3.9
Low Endurance	1.2	5.2	–	6.4
Nearshore/Estuarine	2.0	1.0	1.7	4.7
TOTAL	**6.1**	**7.7**	**4.2**	**18.0**

15–YEAR COST SUMMARY

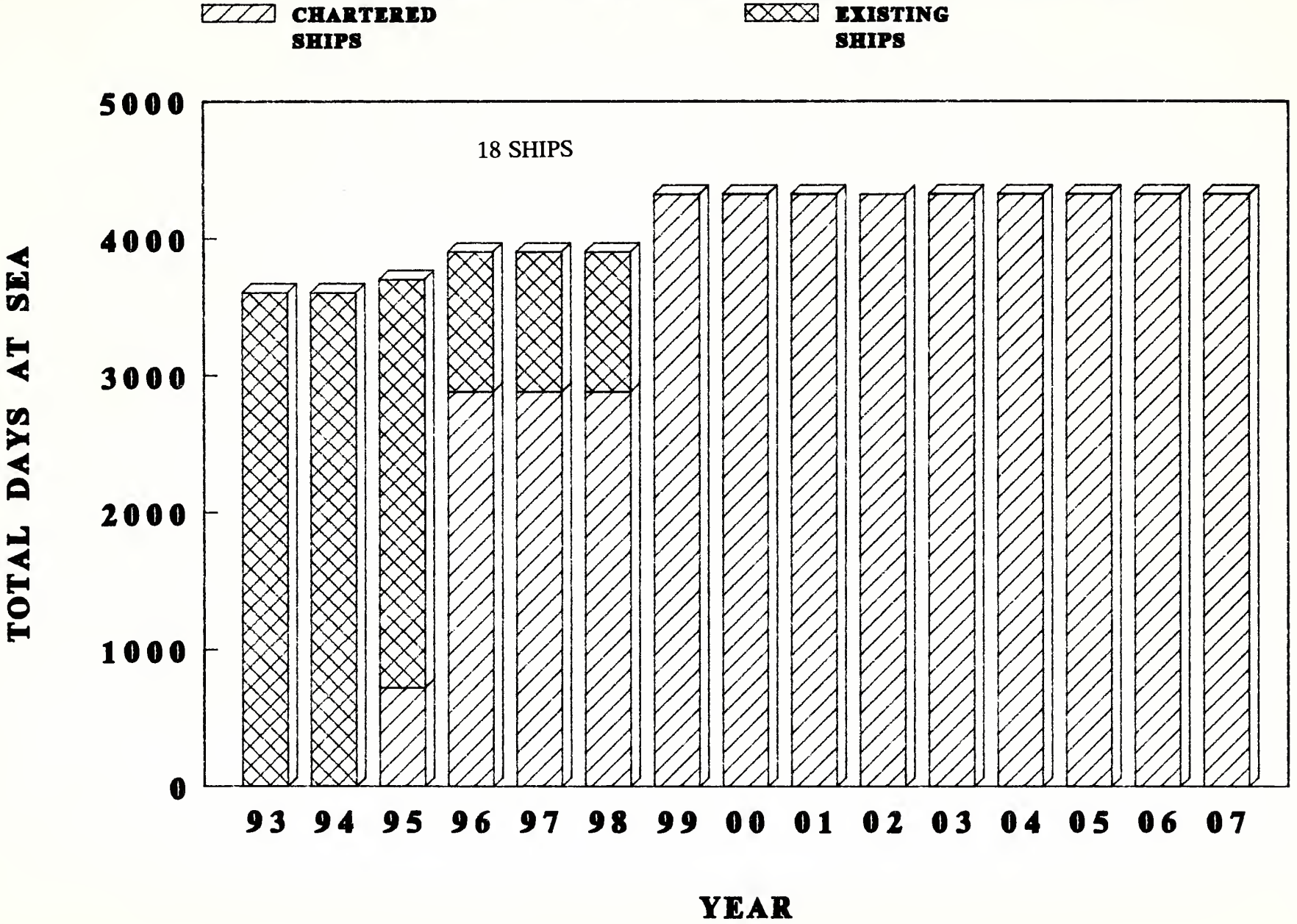
ACTIVITY	COST ($M)
Operating and Support Cost Reduction	$–465.6
Charter Cost	1135.6
Mission Equipment, Mission Personnel and Support Cost	225.6
15–YEAR TOTAL	**$895.6**

NOAA FLEET
CURRENT LEVEL
CHARTER*

	SHIP	FY'93	FY'94	FY'95	FY'96	FY'97	FY'98	FY'99	FY'00	FY'01	FY'02	FY'03	FY'04	FY'05	FY'06	FY'07
High Endurance																
Charting/Oceanography	OI															
LMR/Charting	SU															
Oceanography	MB															
Oceanography	OC	INACTIVE														
Medium Endurance																
Charting (4 Launch) (inactive)	FR	INACTIVE														
Charting (4 Launch)	RR															
Charting (4 Launch)	MI															
LMR/Oceanography	MF															
LMR/Oceanography	RR															
Coastal/Low Endurance																
Charting (2 Launch)	PE	INACTIVE														
Charting (2 Launch)	WH															
Charting (2 Launch)	OR															
LMR	TC															
LMR	OR															
LMR	OS															
LMR	OE															
LMR	CH															
LMR	RL	INACTIVE														
LMR/Oceanography																
Nearshore/Estuarine																
Charting	RU															
Charting	HE															
LMR	JC															
LMR	MU	INACTIVE														
Applied Oceanography	FE															

* KEY TO SHIP ABBREVIATIONS APPEARS ON P. A25.

TOTAL FLEET DAYS AT SEA
CURRENT LEVEL-REPLACEMENT/CHARTER



CURRENT LEVEL/CHARTER ALL SHIPS
COSTS IN 1990 DOLLARS (MILLIONS)

ACTIVITY	FY1993	FY94	FY95	FY96	FY97	FY98	FY99	FY2000	FY01	FY02	FY03	FY04	FY05	FY06	FY07	TOTALS
Operating cost reduction	0.0	0.0	−6.3	−25.2	−25.2	−25.2	−37.8	−37.8	−37.8	−37.8	−37.8	−37.8	−37.8	−37.8	−37.8	−422.1
Support cost reduction	0.0	0.0	0.0	−2.5	−2.5	−2.5	−4.0	−4.0	−4.0	−4.0	−4.0	−4.0	−4.0	−4.0	−4.0	−43.5
Charter cost	0.0	0.0	16.9	60.3	60.3	60.3	104.2	104.2	104.2	104.2	104.2	104.2	104.2	104.2	104.2	1135.6
Mission equipment	25.0	76.0	0.0	0.0	56.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	157.0
Mission personnel	0.0	0.0	0.8	2.4	2.4	2.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	47.6
Commissioning and outfitting	0.0	3.5	10.0	0.0	0.0	7.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	21.0
TOTAL	**25.0**	**79.5**	**21.4**	**35.0**	**91.0**	**42.5**	**66.8**	**66.8**	**66.8**	**66.8**	**66.8**	**66.8**	**66.8**	**66.8**	**66.8**	**895.6**

GRAND TOTAL $895.6

Planning Level A

Construct 25
Construct 23, Charter 2
Charter 25
Construct 23 (300 DAS)
Construct 21, Charter 2 (300 DAS)

Planning Level A – Construct 25

Preliminary Transition Plan

Establishes a 25–NOAA–owned–ship fleet which:
- Replaces 22 existing ships
- Adds 3 new ships.

Deactivated ships are placed back in service to increase DAS.

Ships in poor material condition and/or functionality are replaced early.

Ships to meet new requirements are constructed early in schedule.

Existing ships are repaired to extend service life for the transition period.

Ship operations are increased to 240 DAS upon completion of service–life extension or replacement. Operating costs are increased accordingly.

Construction/replacement program is completed in 15 years with an average cost of $76 million per year and a total cost of $1,142 million.

*Transition Plan Highlights**

PHASE I
FY 1993 – FY 1997

6 ships replaced (SU, TC, OR, RU, HE, JC)
3 ships reactivated (OC, FA, PE)
1 ships conversion (AL)
13 ships service–life extended (DI, FA, RA, MI, MF, MB, PE, WH, DA, DE, CH, AR, FE)
1 ship constructed for new requirements
Construction started on 3 replacement/new ships
Ship operations increased from 3600 to 5280 DAS

Cost $418.5M

PHASE II
FY 1998 – FY 2002

8 ships replaced (OC, MI, MB, PE, DS, DE, AR, FE)
2 new ships completed (H.E. Chartering, L.E. LMR)
Construction started on 4 replacement ships
Ship operations increased from 5280 to 6100 DAS

Cost $472.1M

PHASE III
FY 2003 – FY 2007

8 ships replaced (DI, FA, RA, MF, WH, DA, CH, AL conversion)

Cost $252.0M

TOTAL COST **$1,142.6M**

* Key to Ship Abbreviations appears on p. A25.

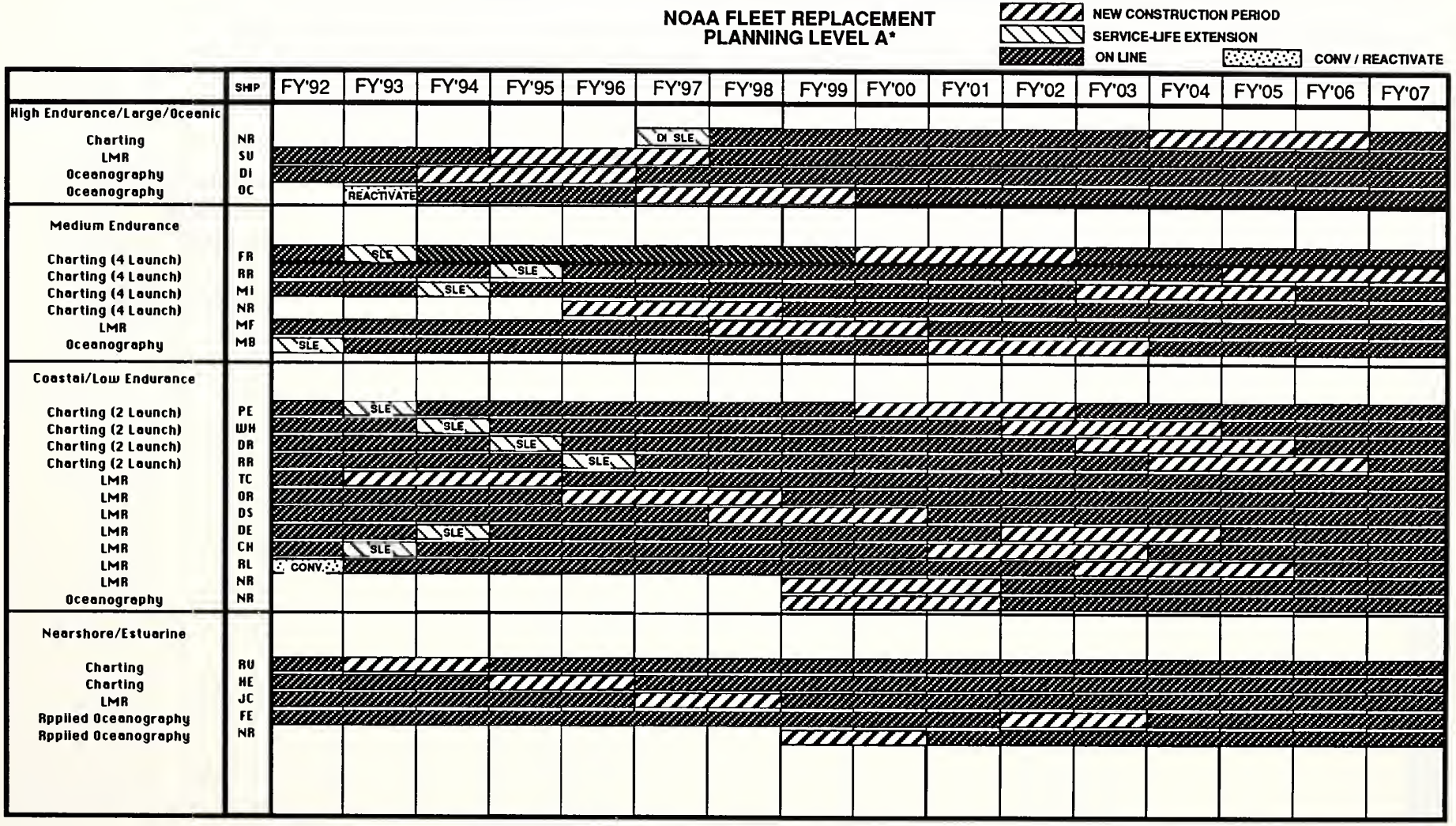
NUMBER AND MIX OF SHIPS
6100 DAS

	CHARTING	LIVING MARINE RESOURCES	OCEANOGRAPHY	TOTAL
High Endurance	1.0	1.0	2.0	4.0
Medium Endurance	3.0	1.0	1.0	5.0
Low Endurance	3.0	7.0	1.0	11.0
Nearshore/Estuarine	2.0	1.0	2.0	5.0
TOTAL	**9.0**	**10.0**	**6.0**	**25.0**

15–YEAR COST SUMMARY

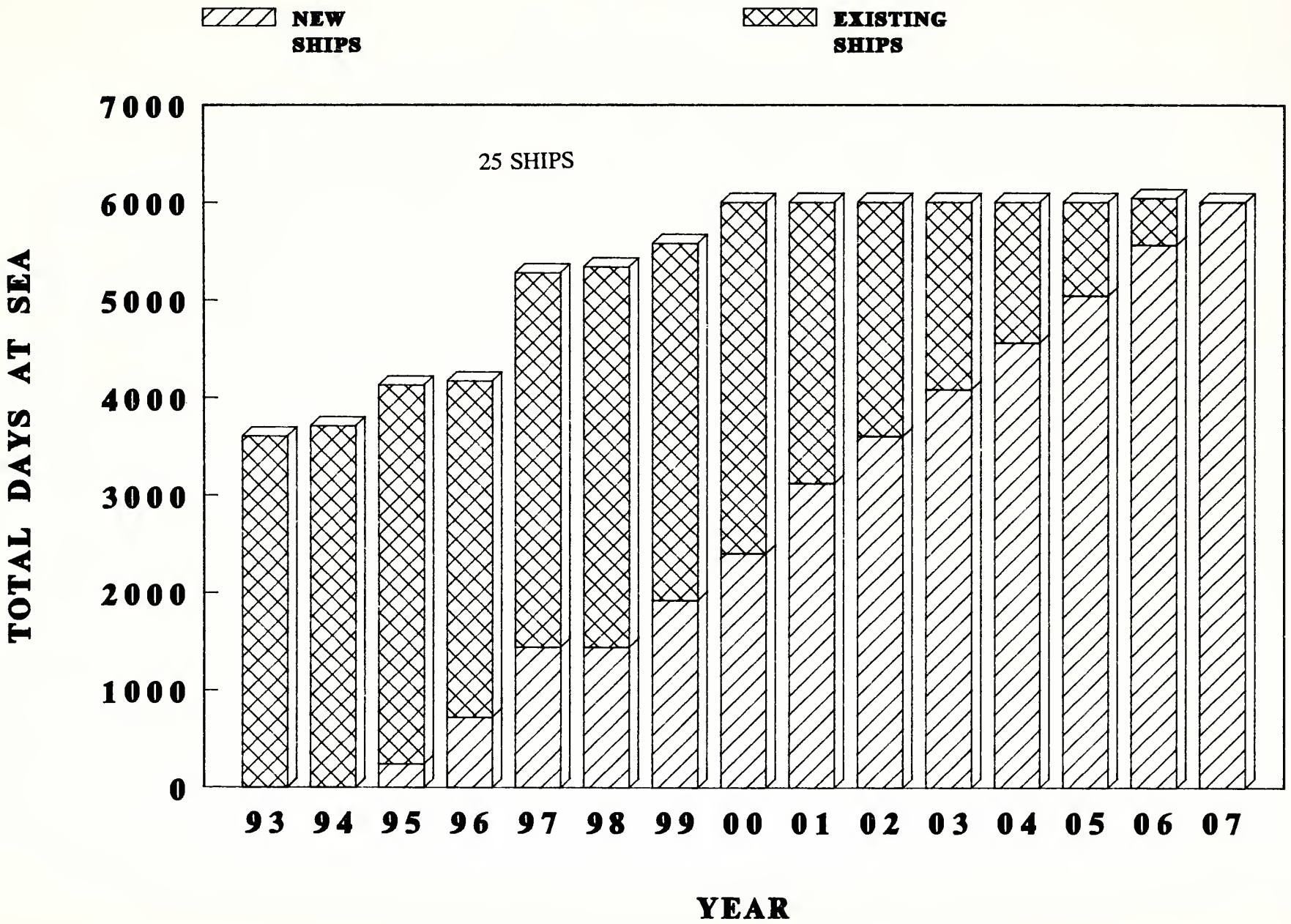
ACTIVITY	COST ($M)
Service–Life Extension/Conversion	$ 77.0
New Ship Construction	738.0
Support Cost (operating, project, commissioning, change orders)	327.6
15–YEAR TOTAL	**$1,142.6**

NOAA FLEET REPLACEMENT PLANNING LEVEL A*



* KEY TO SHIP ABBREVIATIONS APPEARS ON P. A25.

TOTAL FLEET DAYS AT SEA
PLANNING LEVEL A



PLANNING LEVEL A
NEW CONSTRUCTION
COSTS IN 1990 DOLLARS (MILLIONS)

ACTIVITY	FY1993	FY94	FY95	FY96	FY97	FY98	FY99	FY2000	FY01	FY02	FY03	FY04	FY05	FY06	FY07	TOTALS
Service life extension	19.0	22.0	15.0	19.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	77.0
Conversions	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Replacement vessels	38.0	50.0	38.0	53.0	0.0	64.0	70.0	66.0	70.0	70.0	76.0	64.0	0.0	0.0	0.0	659.0
New requirements	0.0	0.0	13.0	0.0	66.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	79.0
New operating costs	0.0	11.5	11.5	11.5	11.5	13.5	14.5	18.5	18.5	18.5	18.5	18.5	18.5	18.5	18.5	222.0
Project costs	0.7	1.0	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	0.5	0.5	0.5	0.0	14.0
Commissioning/ changing orders	4.6	6.0	7.3	6.4	7.9	7.9	7.8	7.9	10.6	8.4	9.1	7.7	0.0	0.0	0.0	91.6
TOTAL	**62.3**	**90.5**	**86.0**	**91.1**	**88.6**	**86.6**	**93.5**	**93.6**	**100.3**	**98.1**	**104.8**	**90.7**	**19.0**	**19.0**	**18.5**	**1142.6**

GRAND TOTAL $1142.6

Planning Level A – Construct 23, Charter 2

Preliminary Transition Plan

Establishes a 23–NOAA–owned–ship fleet which:
- Replaces 21 existing ships
- Adds 2 new ships.

2 high–endurance ships are potential charter/contract with:
- Charting at 240 DAS
- LMR at 180 DAS.

Construction/replacement/charter program is completed in 15 years with an average cost of $74 million per year and a total cost of $1,104 million.

*Transition Plan Highlights**

PHASE I
FY 1993 – FY 1997

5 ships replaced (TC, OR, RU, HE, JC)
3 ships reactivated (OC, FA, PE)
1 ship conversion (AL)
13 ships service–life extended (DI, FA, RA, MI, MF, MB, PE, WH, DA, DE, CH, AR, FE)
1 ship constructed for new requirements
2 ships on charter/contract (SU, new requirement)

Cost	$401.5M

PHASE II
FY 1998 – 2002

7 ships replaced (OC, MI, MB, PE, DS, AR, FE)
1 ship constructed for new requirement
2 ships on charter/contract (SU, new requirement)

Cost	$442.1M

PHASE III
FY 2003 – 2007

7 ships replaced (DI, FA, RA, MF, WH, DA, AL conversion)
1 ship constructed for new requirement
2 ships on charter/contract (SU, new requirement)

Cost	$261.0M
TOTAL COST	**$1,104.6M**

* Key to Ship Abbreviations appears on p. A25.

NUMBER AND MIX OF SHIPS
6100 DAS*

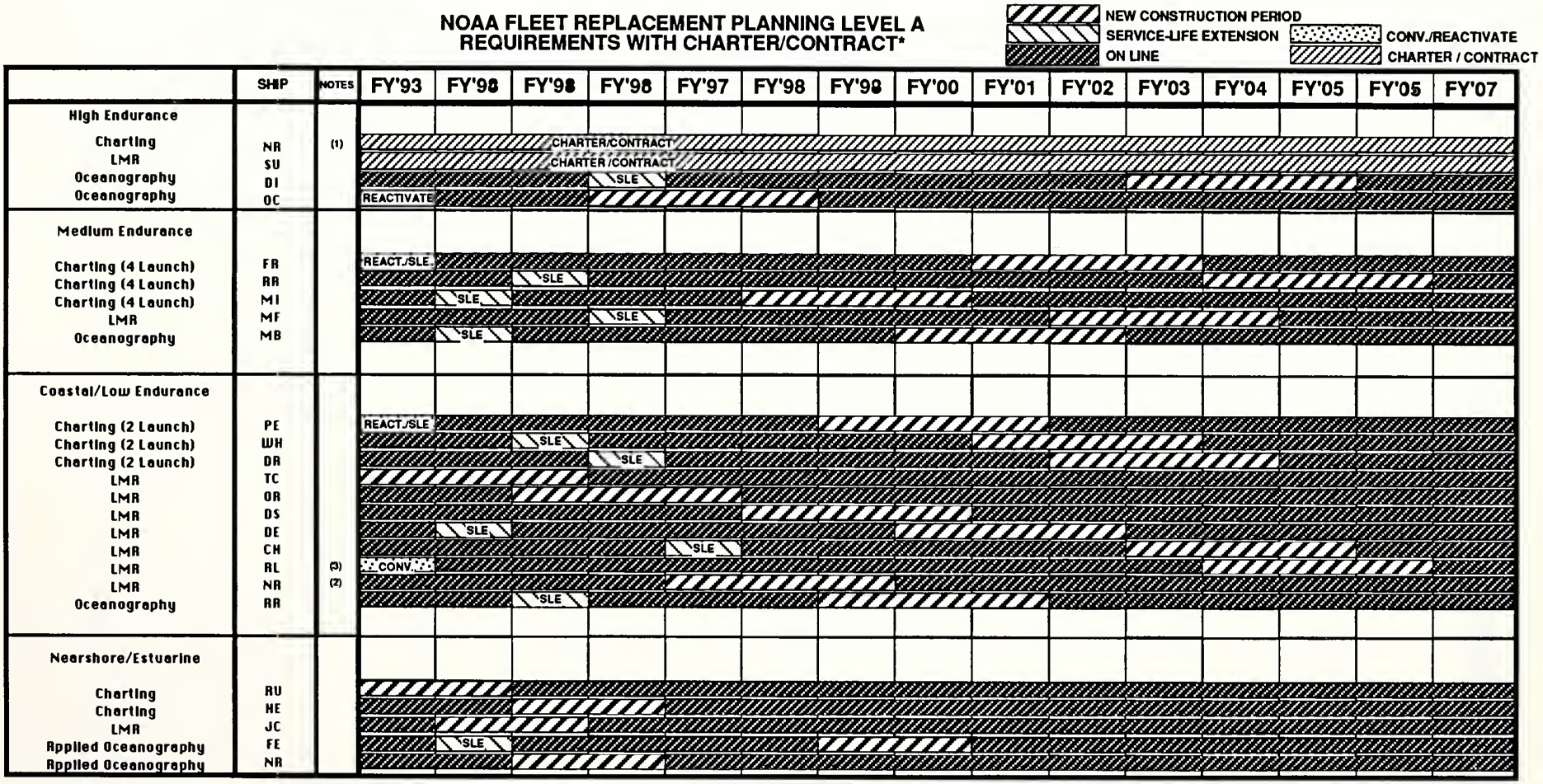
	CHARTING	LIVING MARINE RESOURCES	OCEANOGRAPHY	TOTAL
High Endurance	1.0**	1.0**	2.0	4.0
Medium Endurance	3.0	1.0	1.0	5.0
Low Endurance	3.0	7.0	1.0	11.0
Nearshore/Estuarine	2.0	1.0	2.0	5.0
TOTAL	**9.0**	**10.0**	**6.0**	**25.0**

* 240 DAS per ship ** Charter/contract

15–YEAR COST SUMMARY

ACTIVITY	COST ($M)
Service–Life Extension/Conversion	$ 77.0
New Ship Construction	656.0
Support Cost (operating, project, commissioning, change orders)	239.6
Charter/Contract	132.0
15–YEAR TOTAL	**$1,104.6**

NOAA FLEET REPLACEMENT PLANNING LEVEL A REQUIREMENTS WITH CHARTER/CONTRACT*



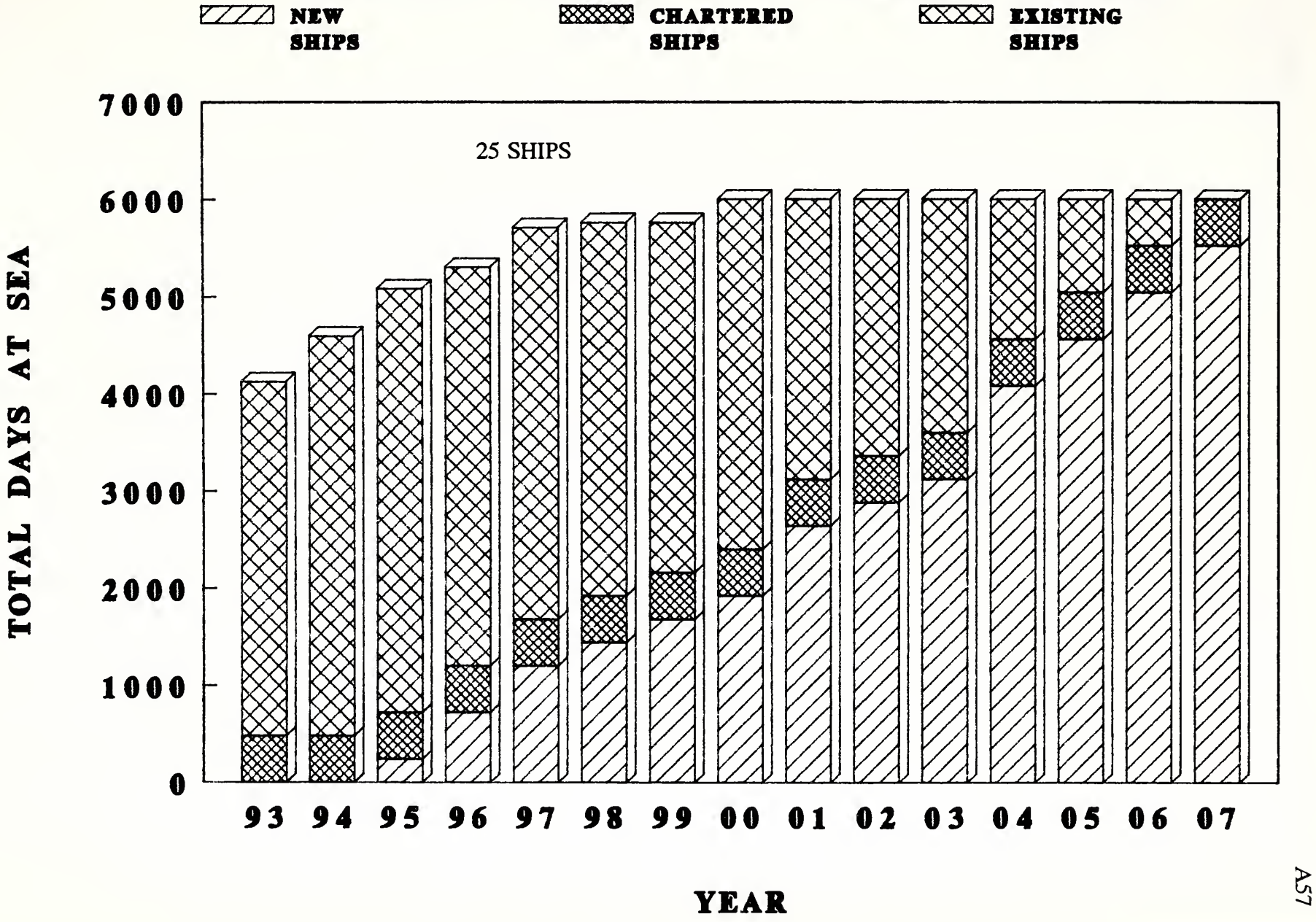
* KEY TO SHIP ABBREVIATIONS APPEARS ON P. A25.

NOTES: (1) AFTER DISCOVERER REPLACEMENT AND SERVICE-LIFE EXTENSION, THE DISCOVERER PERFORMS NEW MISSION REQUIREMENT.

(2) OSV CONVERSION IMMEDIATELY REPLACES DEACTIVE ALBATROSS IV.

(3) ASSUMES FUNDING AVAILABLE IN FISCAL YEAR 92 FOR CONVERSION.

TOTAL FLEET DAYS AT SEA
PLANNING LEVEL A WITH CHARTER/CONTRACT



PLANNING LEVEL A
NEW CONSTRUCTION WITH CHARTER/CONTRACT
COSTS IN 1990 DOLLARS (MILLIONS)

ACTIVITY	FY1993	FY94	FY95	FY96	FY97	FY98	FY99	FY2000	FY01	FY02	FY03	FY04	FY05	FY06	FY07	TOTALS
Service life extension	19.0	22.0	15.0	19.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	77.0
Conversions	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Replacement vessels	38.0	9.0	38.0	53.0	0.0	23.0	70.0	66.0	70.0	70.0	76.0	64.0	0.0	0.0	0.0	577.0
New requirements	0.0	0.0	13.0	0.0	66.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	79.0
New operating costs	−4.0	7.5	7.5	7.5	7.5	9.5	6.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	134.0
Project costs	0.7	1.0	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	0.5	0.5	0.5	0.0	14.0
Charter	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	132.0
Commissioning/ changing orders	4.6	6.0	7.3	6.4	7.9	7.9	7.8	7.9	10.6	8.4	9.1	7.7	0.0	0.0	0.0	91.6
TOTAL	**67.1**	**54.3**	**90.8**	**95.9**	**93.4**	**50.4**	**94.3**	**95.4**	**102.1**	**99.9**	**106.6**	**92.5**	**20.8**	**20.8**	**20.3**	**1104.6**
															GRAND TOTAL	**$1104.6**

Planning Level A – Charter 25

Preliminary Transition Plan

Establishes a 25–ship fleet.

Start of charter period for NOAA ships coincides with remaining service life.

DAS are increased from 3600 to 6100 by 2001.

Charter program has an average cost of $98 million per year and a total cost of $1,465 million.

Transition Plan Highlights

PHASE I
FY 1993 – FY 1997

Number of ships increased from 18 to 25
18 ships chartered
DAS increased from 3600 to 5700

Cost	$368.7M

PHASE II
FY 1998 – FY 2002

All 25 ships chartered
DAS increased from 5700 to 6100

Cost	$544.9M

PHASE III
FY 2003 – 2007

Chartered ships operating at 240 DAS

Cost	$551.5M
TOTAL COST	**$1465.1M**

NUMBER AND MIX OF SHIPS
6100 DAS*

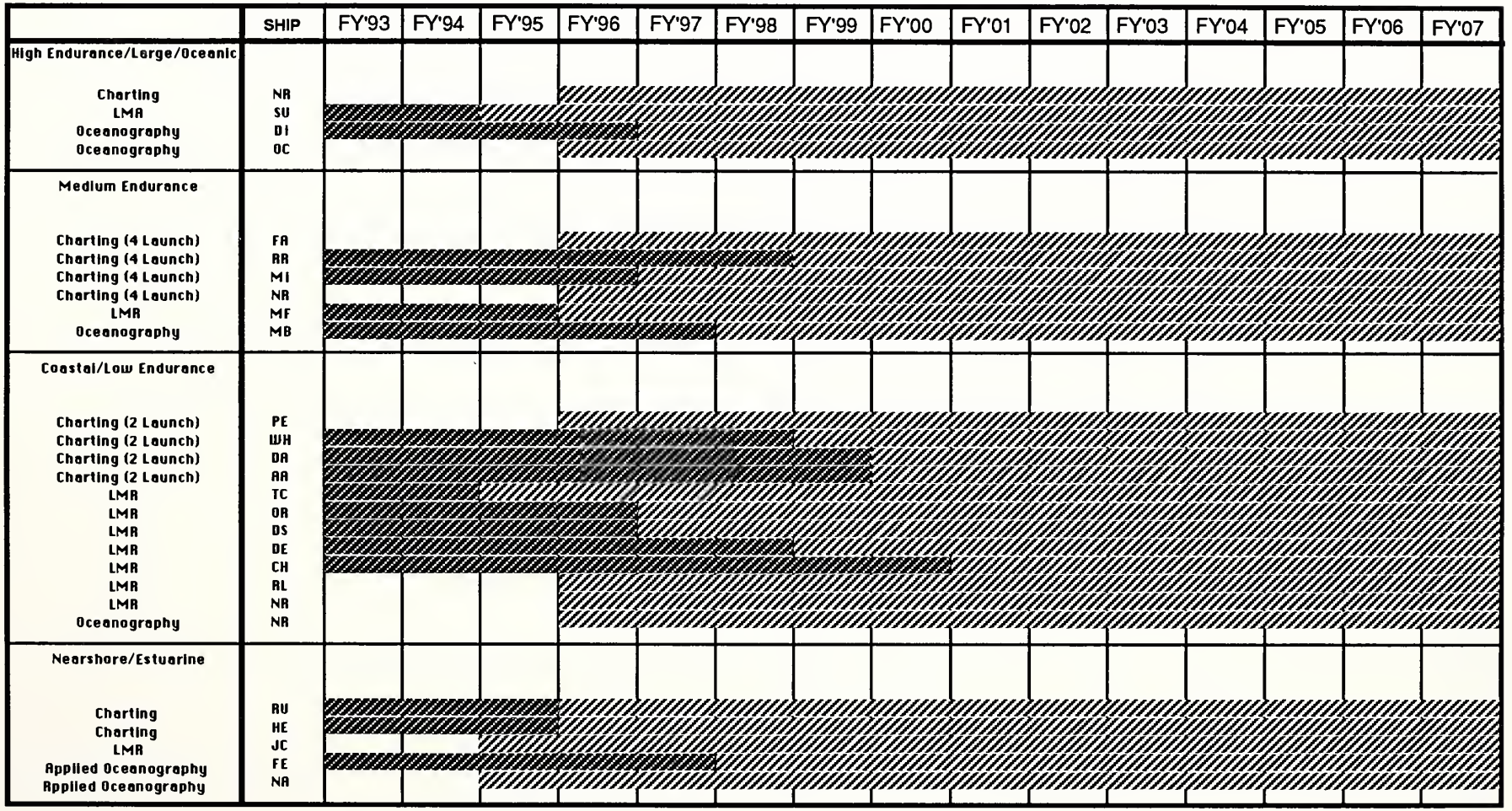
	CHARTING	LIVING MARINE RESOURCES	OCEANOGRAPHY	TOTAL
High Endurance	1.0	1.0	2.0	4.0
Medium Endurance	3.0	1.0	1.0	5.0
Low Endurance	3.0	7.0	1.0	11.0
Nearshore/Estuarine	2.0	1.0	2.0	5.0
TOTAL	**9.0**	**10.0**	**6.0**	**25.0**

* 240 DAS per ship

15-YEAR COST SUMMARY

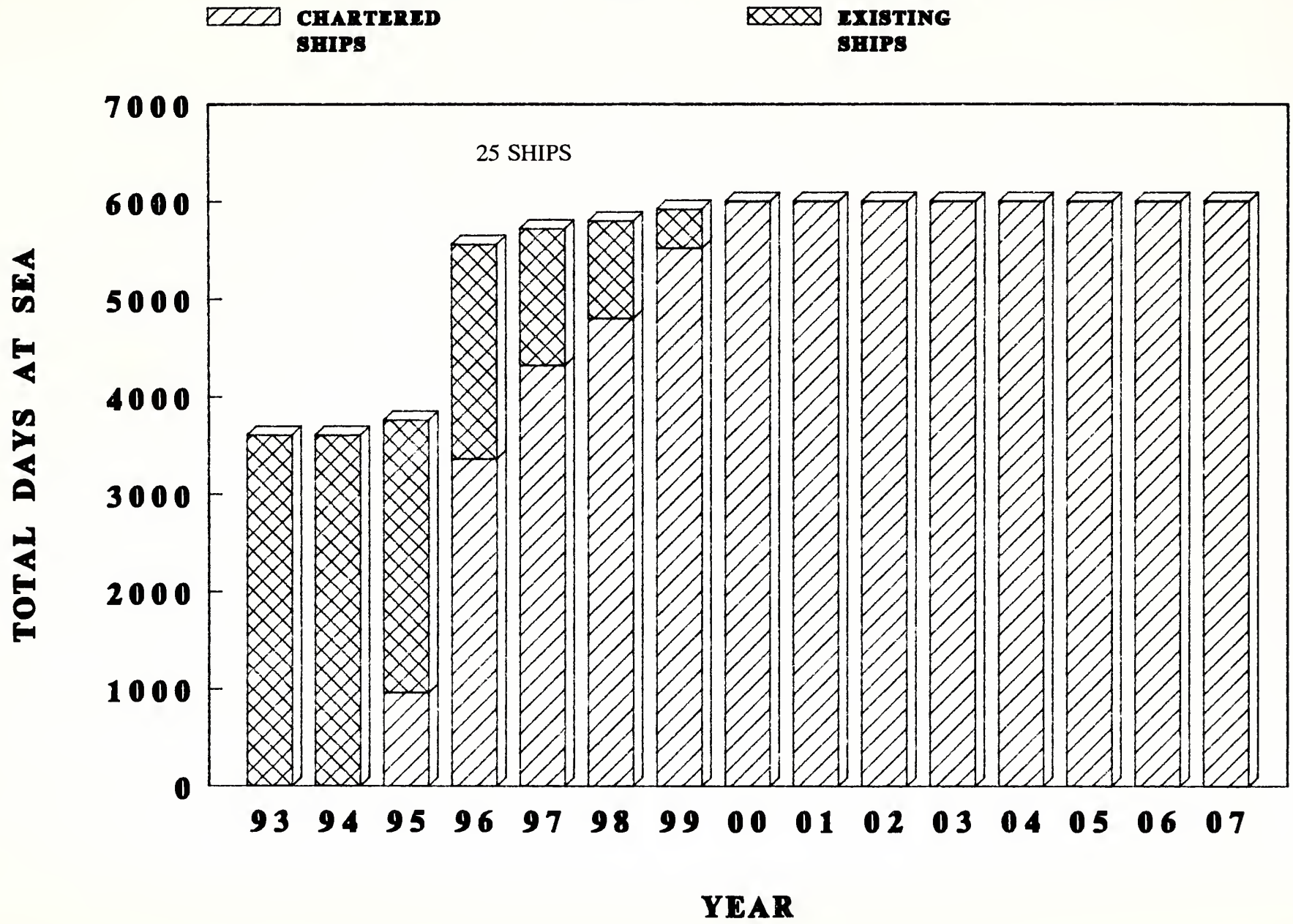
ACTIVITY	COST ($M)
Charter/Contract	$ 330.1
Support Cost	1135.0
15-YEAR TOTAL	**$1465.1**

NOAA FLEET REPLACEMENT PLANNING LEVEL A ALL SHIPS CHARTERED*



* KEY TO SHIP ABBREVIATIONS APPEARS ON P. A25.

TOTAL FLEET DAYS AT SEA
PLANNING LEVEL A - CHARTER ALL SHIPS



PLANNING LEVEL A/ALL CHARTER
COSTS IN 1990 DOLLARS (MILLIONS)

ACTIVITY	FY1993	FY94	FY95	FY96	FY97	FY98	FY99	FY2000	FY01	FY02	FY03	FY04	FY05	FY06	FY07	TOTALS
Operating cost reduction	0.0	0.0	−6.3	−25.2	−25.2	−25.2	−37.8	−37.8	−37.8	−37.8	−37.8	−37.8	−37.8	−37.8	−37.8	−422.1
Support cost reduction	0.0	0.0	0.0	−2.5	−2.5	−2.5	−4.0	−4.0	−4.0	−4.0	−4.0	−4.0	−4.0	−4.0	−4.0	−43.5
Charter cost	0.0	0.0	19.6	81.5	99.2	116.1	133.8	143.8	143.8	143.8	143.8	143.8	143.8	143.8	143.8	1600.6
Mission equipment	27.5	92.0	26.0	20.0	26.0	16.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	207.5
Mission personnel	0.0	0.0	1.0	6.3	6.8	7.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	96.1
Commissioning and outfitting	0.0	4.0	13.5	3.5	3.5	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	26.5
TOTAL	**27.5**	**96.0**	**53.8**	**83.6**	**107.8**	**113.7**	**100.3**	**110.3**	**110.3**	**110.3**	**110.3**	**110.3**	**110.3**	**110.3**	**110.3**	**1465.1**

GRAND TOTAL $1465.1

Planning Level A – Construct 23 (300 DAS)

Preliminary Transition Plan

Establishes a 23–NOAA–owned–ship fleet which:
- Replaces 21 existing ships
- Adds 2 new ships.

High– and medium–endurance ships are increased to 300 DAS per year after replacement.

Low–endurance and nearshore/estuarine ships operate at 240 DAS per year after service–life extension or replacement.

The requirement for one high–endurance and one medium–endurance ship is reduced from the minimum 240 DAS level.

MT. MITCHELL is removed from service in Fiscal Year 95.

Deactivated ships are placed back in service to increase DAS.

Ships in poor material condition and/or functionality are replaced early.

Ships to meet new requirement are constructed early in schedule.

Existing ships are service–life extended for the transition period.

Operating and maintenance costs for high–and medium–endurance ships increased to reflect DAS operations.

Construction/replacement program is completed in 15 years with an average cost of $70 million per year and a total cost of $1,048 million.

*Transition Plan Highlights**

PHASE I
FY 1993 – FY 1997

5 ships replaced (SU, TC, OR, RU, HE)
3 ships reactivated (OC, FA, PE)
1 ship conversion (AL)
11 ships service-life extended (DI, FA, RA, MF, MB, PE, DA, DE, CH, AR, FE)
Construction started on 3 replacement/new ships
Ship operations increased from 3600 to 5520 DAS

Cost $475.1M

PHASE II
FY 1998 – FY 2002

8 ships replaced (OC, MF, MB, PE, WH, DS, JC, FE)
2 ships constructed for new requirements
Construction on 4 replacement ships
Ship operations increased from 5520 to 6100 DAS

Cost $397.8M

PHASE III
FY 2003 – FY 2007

8 ships replaced (DI, FA, RA, DA, DE, CH, AL, AR)

Cost $174.7M

TOTAL COST **$1,047.6M**

* Key to Ship Abbreviations appears on p. A25.

NUMBER AND MIX OF SHIPS
6100 DAS

	CHARTING	LIVING MARINE RESOURCES	OCEANOGRAPHY	TOTAL
High Endurance	1.0	0.7	1.3	3.0
Medium Endurance	2.0	1.0	1.0	4.0
Low Endurance	3.0	7.0	1.0	11.0
Nearshore/Estuarine	2.0	1.0	2.0	5.0
TOTAL	**8.0**	**9.7**	**5.3**	**23.0**

15–YEAR COST SUMMARY

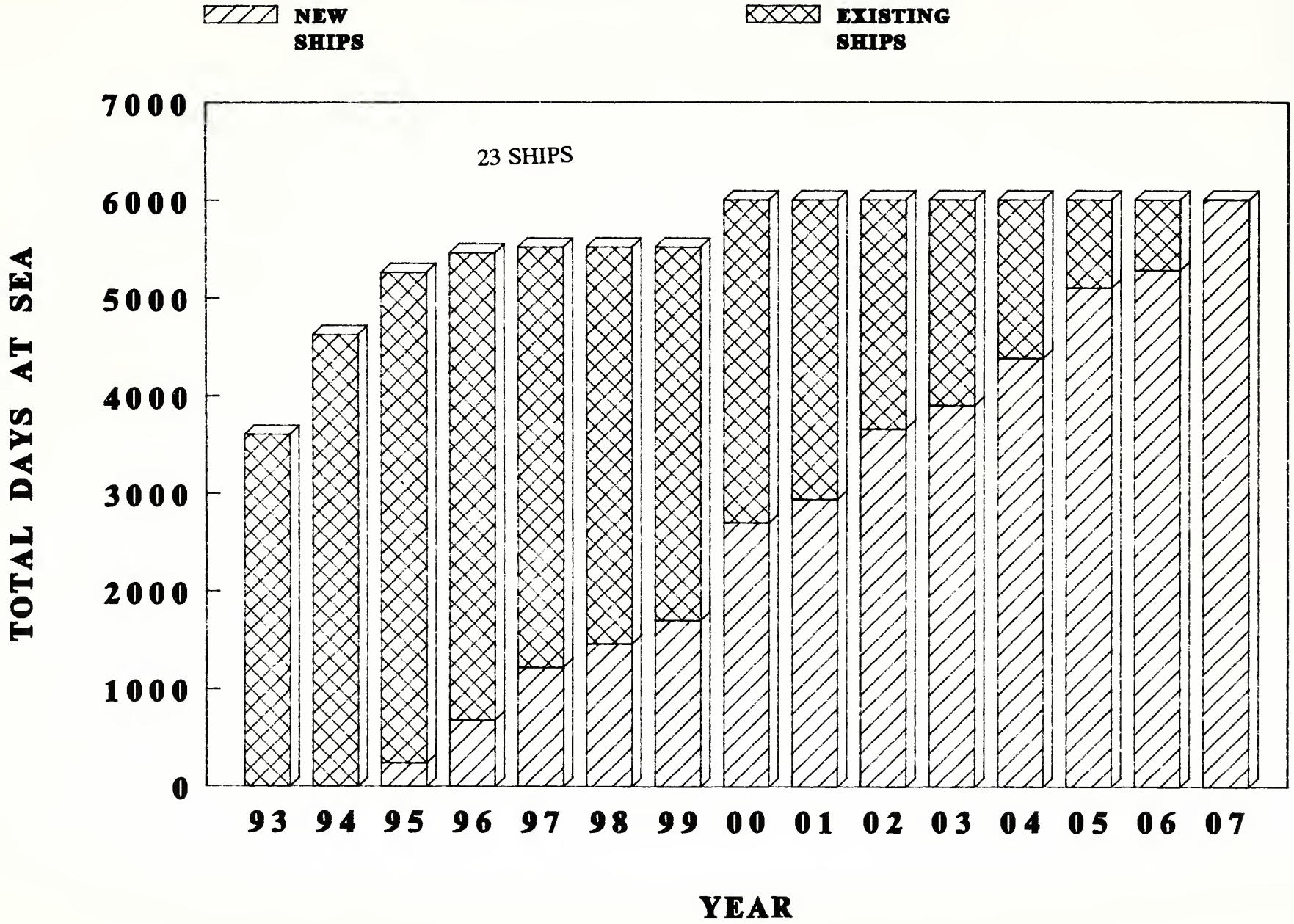
ACTIVITY	COST ($M)
Service–Life Extension/Conversion – 12 ships	$ 84.5
New Ship Construction – 23 ships	691.0
Support Cost (operating, project, commissioning, change orders)	272.1
15–YEAR TOTAL	**$1,047.6**

NOAA FLEET REPLACEMENT
PLANNING LEVEL A REQUIREMENTS
HIGH AND MEDIUM ENDURANCE @ 300 DAS*

	SHIP	FY'93	FY'94	FY'95	FY'96	FY'97	FY'98	FY'99	FY'00	FY'01	FY'02	FY'03	FY'04	FY'05	FY'06	FY'07
High Endurance																
Charting	SU															
LMR/Oceanography	DI			SLE												
Oceanography	OC	REACTIVATE														
Medium Endurance																
Charting (4 Launch)	FR	REACTIVATE														
Charting (4 Launch)	RR		SLE													
Charting (4 Launch)	MI			OUT OF SERVICE												
LMR	MF				SLE											
Oceanography	MB		SLE													
Coastal/Low Endurance																
Charting (2 Launch)	PE	REACTIVATE														
Charting (2 Launch)	WH															
Charting (2 Launch)	DR			SLE												
LMR	TC															
LMR	OR															
LMR	DS															
LMR	DE			SLE												
LMR	CH		SLE													
LMR	RL	CONV.														
LMR	NR															
Oceanography	RR				SLE											
Nearshore/Estuarine																
Charting	RU															
Charting	HE															
LMR	JC															
Applied Oceanography	FE	SLE														
Applied Oceanography	NR															

* KEY TO SHIP ABBREVIATIONS APPEARS ON P. A25.

TOTAL FLEET DAYS AT SEA
PLANNING LEVEL A - 300 DAS



PLANNING LEVEL A (300 DAS)
NEW CONSTRUCTION
COSTS IN 1990 DOLLARS (MILLIONS)

ACTIVITY	FY1993	FY94	FY95	FY96	FY97	FY98	FY99	FY2000	FY01	FY02	FY03	FY04	FY05	FY06	FY07	TOTALS
Service life extension	21.0	9.0	17.0	9.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	56.0
Conversions	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Replacement vessels	38.0	43.0	48.0	53.0	38.0	44.0	52.0	65.0	52.0	51.0	53.0	41.0	41.0	23.0	0.0	642.0
New requirements	0.0	0.0	13.0	0.0	23.0	13.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	49.0
New operating costs	0.0	11.5	11.5	11.5	11.5	13.5	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	194.5
Project costs	0.7	1.0	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	0.5	0.5	0.5	0.5	14.5
Commissioning/ changing orders	4.6	6.0	7.3	6.4	7.9	7.9	7.8	7.9	10.6	8.4	9.1	7.7	0.0	0.0	0.0	91.6
TOTAL	**64.3**	**70.5**	**98.0**	**81.1**	**81.6**	**79.6**	**76.0**	**89.1**	**78.8**	**75.6**	**78.3**	**64.2**	**56.5**	**38.5**	**15.5**	**1047.6**

GRAND TOTAL $1047.6

Planning Level A – Construct 21, Charter 2 (300 DAS)

Preliminary Transition Plan

Establishes a 21 NOAA-owned-ship fleet which:
- Replaces 19 existing ships
- Adds 2 new ships.

2 ships are potential charter/contract with:
- Charting at 240 DAS
- LMR at 180 DAS.

High- and medium-endurance ships are increased to 300 DAS per year after replacement.

Low-endurance and nearshore/estuarine ships operate at 240 DAS per year after service-life extension or replacement.

Construction/replacement/charter program will be completed in 15 years and has an average cost of $72 million per year and a total cost of $1,077 million.

*Transition Plan Highlights**

PHASE I
FY 1993 – FY 1997

4 ships replaced (TC, OR, RU, HE)
2 ships reactivated (FA, PE)
1 ship conversion (AL)
9 ships service–life extended (DI, RA, MF, MB, DA, DE, CH, AR, FE)
2 ships out–of–service (OC, MI)
2 ships on charter/contract (SU, new requirement)
Construction started on 3 replacement/new ships
Ship operations increased from 3600 to 5520 DAS

Cost $380.5M

PHASE II
FY 1998 – 2002

7 ships replaced (MF, MB, WH, DS, DE, JC, FE)
2 ships out–of–service (OC, MI)
2 ships on charter/contract (SU, new requirement)
2 ships constructed for new requirements
Construction started on 4 replacement ships
Ship operations increased from 5520 to 6100 DAS

Cost $422.1M

PHASE III
FY 2003 – 2007

8 ships replaced (DI, FA, RA, DA, DE, CH, AL conversion, AR)
2 ships out–of–service (OC, MI)

Cost $274.5M

TOTAL COST **$1,077.1M**

* Key to Ship Abbreviations appears on p. A25.

NUMBER AND MIX OF SHIPS
6100 DAS*

	CHARTING	LIVING MARINE RESOURCES	OCEANOGRAPHY	TOTAL
High Endurance	1.0**	0.7**	1.3	3.0
Medium Endurance	2.0	1.0	1.0	4.0
Low Endurance	3.0	7.0	1.0	11.0
Nearshore/Estuarine	2.0	1.0	2.0	5.0
TOTAL	**8.0**	**9.7**	**5.3**	**23.0**

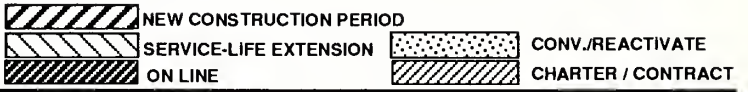
* High– and Medium–Endurance at 300 DAS
Low–Endurance and Nearshore/Estuarine at 240 DAS

** Charter/contract

15–YEAR COST SUMMARY

ACTIVITY	COST ($M)
Service–Life extension/Conversion – 9 ships	$ 56.0
New Ship Construction – 22 ships	648.0
Support Cost (operating, project, commissioning, change orders)	241.1
Charter/Contract – 2 ships	132.0
15 YEAR TOTAL	**$1,077.1**

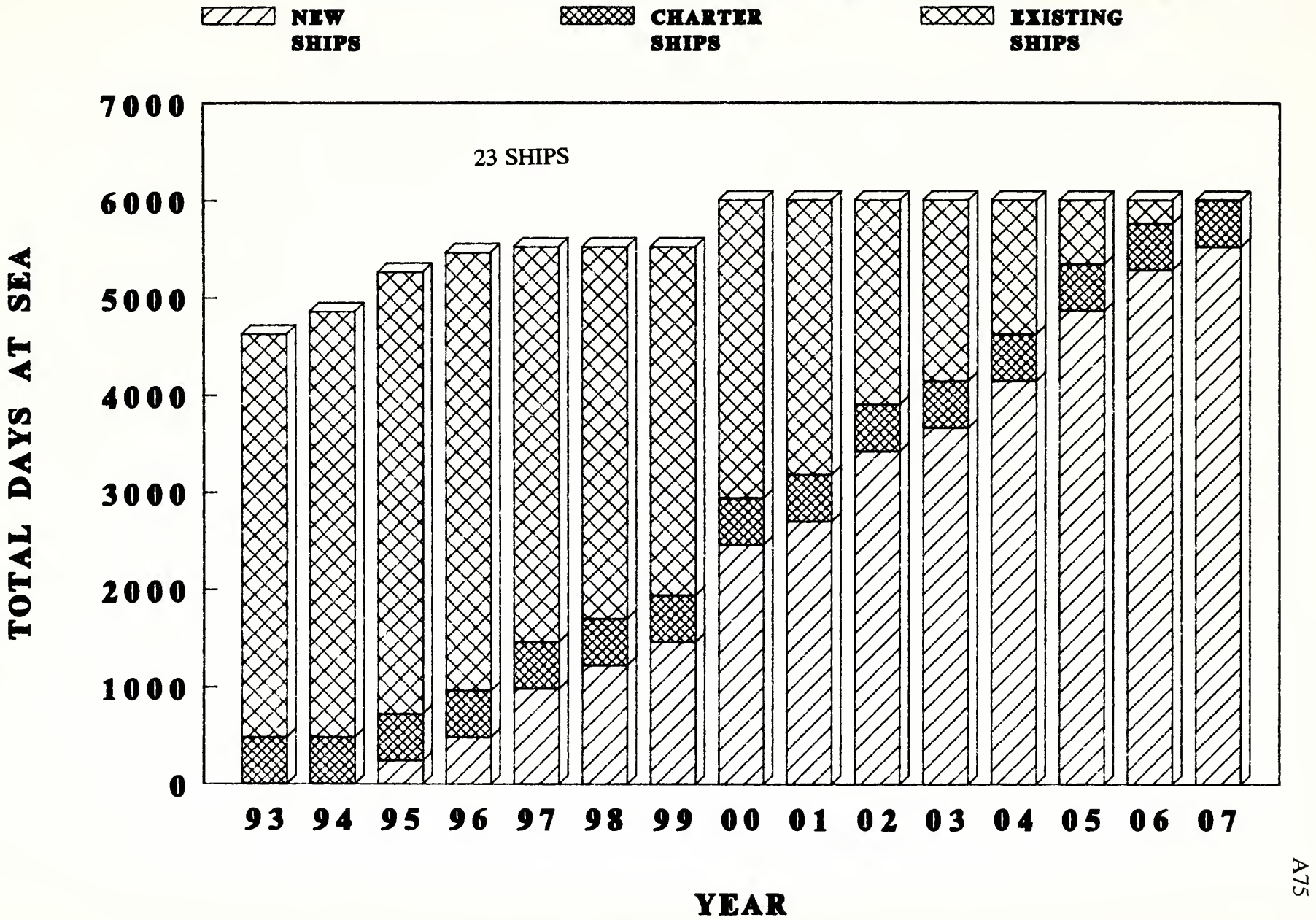
NOAA FLEET REPLACEMENT
PLANNING LEVEL A CHARTER/CONTRACT
HIGH AND MEDIUM ENDURANCE @ 300 DAS*



	SHIP	FY'93	FY'94	FY'95	FY'96	FY'97	FY'98	FY'99	FY'00	FY'01	FY'02	FY'03	FY'04	FY'05	FY'06	FY'07
High Endurance																
Charting	NA	CHARTER / CONTRACT														
LMA	SU	CHARTER / CONTRACT														
Oceanography/Chart	DI			SLE												
Oceanography	OC	OUT OF SERVICE														
Medium Endurance																
Charting (4 Launch)	FA	REACTIVATE														
Charting (4 Launch)	AA		SLE													
Charting (4 Launch)	MI			OUT OF SERVICE												
LMA	MF				SLE											
Oceanography	MB		SLE													
Coastal/Low Endurance																
Charting (2 Launch)	PE	REACTIVATE														
Charting (2 Launch)	WH															
Charting (2 Launch)	OA			SLE												
LMA	TC															
LMA	OA															
LMA	OS															
LMA	OE			SLE												
LMA	CH		SLE													
LMA	AL	CONV.														
LMA	NA															
Oceanography	AA				SLE											
Nearshore/Estuarine																
Charting	AU															
Charting	HE															
LMA	JC															
Applied Oceanography	FE	SLE														
Applied Oceanography	NA															

* KEY TO SHIP ABBREVIATIONS APPEARS ON P. A25.

TOTAL FLEET DAYS AT SEA
PLANNING LEVEL A - 300 DAS WITH CHARTER



PLANNING LEVEL A (300 DAS)
CHARTER/CONTRACT
COSTS IN 1990 DOLLARS (MILLIONS)

ACTIVITY	FY1993	FY94	FY95	FY96	FY97	FY98	FY99	FY2000	FY01	FY02	FY03	FY04	FY05	FY06	FY07	TOTALS
Service life extension	21.0	9.0	17.0	9.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	56.0
Conversions	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Replacement vessels	38.0	0.0	48.0	53.0	38.0	44.0	52.0	65.0	52.0	51.0	53.0	41.0	41.0	23.0	0.0	599.0
New requirements	0.0	0.0	13.0	0.0	23.0	13.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	49.0
New operating costs	0.0	7.5	7.5	7.5	7.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	135.0
Project costs	0.7	1.0	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	0.5	0.5	0.5	0.5	14.5
Charter costs	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	132.0
Commissioning/ changing orders	4.6	6.0	7.3	6.4	7.9	7.9	7.8	7.9	10.6	8.4	9.1	7.7	0.0	0.0	0.0	91.6
TOTAL	**73.1**	**32.3**	**102.8**	**85.9**	**86.4**	**85.4**	**80.3**	**93.4**	**83.1**	**79.9**	**82.6**	**68.5**	**60.8**	**42.8**	**19.8**	**1077.1**

GRAND TOTAL $1077.1

Planning Level B

Construct 33
Construct 26, Charter 7
Construct 31 (300 DAS)
Construct 24, Charter 7 (300 DAS)

Planning Level B – Construct 33

Preliminary Transition Plan

Establishes a 33–NOAA–owned–ship fleet which:
- Replaces 22 existing ships
- Adds 11 new ships.

Deactivated ships are placed back in service to increase DAS.

Ships in poor material condition and/or functionality are replaced early.

Ships to meet new requirements are constructed early in schedule.

Existing ships are service–life extended for the transition period.

OREGON II supports low–endurance oceanography new requirement starting in 1998.

Ship operations are increased to 240 DAS upon completion of service–life extension or replacement.

Construction/replacement program is completed in 15 years with an average cost of $100 million per year and a total cost of $1,500 million.

*Transition Plan Highlights**

PHASE I
FY 1993 – FY 1997

7 ships replaced (SU, DI, TC, OR, RU, HE, JC)
3 ships reactivated (OC, FA, PE)
1 ship conversion (AL)
12 ships service–life extended (DI, FA, RA, MI, MF, MB, PE, WH, DA, AR, DS, DE)
2 ships constructed for new requirements
Construction started on 4 replacement/new ships
Ship operations increased from 3600 to 5760 DAS

Cost $512.3M

PHASE II
FY 1998 – FY 2002

6 ships replaced (OC, FA, MF, PE, WH, FE)
2 ships service–life extended (CH, OR)
4 ships constructed for new requirements
Construction started on 4 replacement ships
Ship operations increased from 5760 to 7910 DAS

Cost $553.8M

PHASE III
FY 2003 – FY 2007

9 ships replaced (FA, RA, MB, DA, AR, DS, DE, CH, AL conversion)
2 ships constructed for new requirements

Cost $434.3M

TOTAL COST **$1,500.4M**

* Key to Ship Abbreviations appears on p. A25.

NUMBER AND MIX OF SHIPS
7910 DAS*

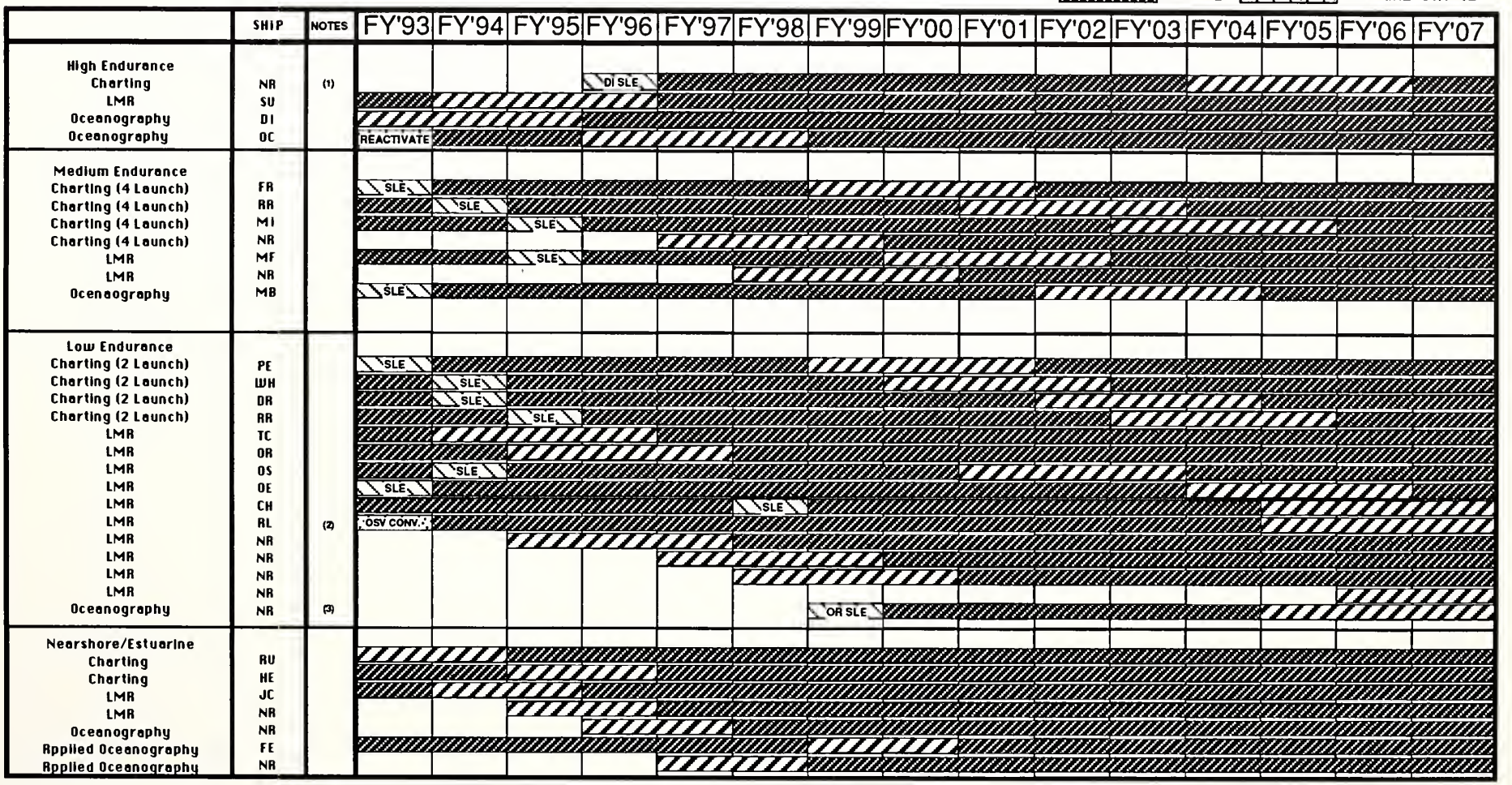
	CHARTING	LIVING MARINE RESOURCES	OCEANOGRAPHY	TOTAL
High Endurance	1.0	0.8	2.3	4.1
Medium Endurance	4.0	2.0	1.1	7.1
Low Endurance	4.0	9.7	1.2	14.9
Nearshore/Estuarine	2.0	2.0	2.9	6.9
TOTAL	**11.0**	**14.5**	**7.5**	**33.0**

* 240 DAS per ship

15–YEAR COST SUMMARY

ACTIVITY	COST ($M)
Service–Life Extension/Conversion – 15 ships	$ 82.0
New Ship Construction – 33 ships	940.0
Support Cost (operating, project, commissioning, change orders)	478.4
15–YEAR TOTAL	**$1,500.4**

NOAA FLEET REPLACEMENT PLANNING LEVEL B REQUIREMENTS*



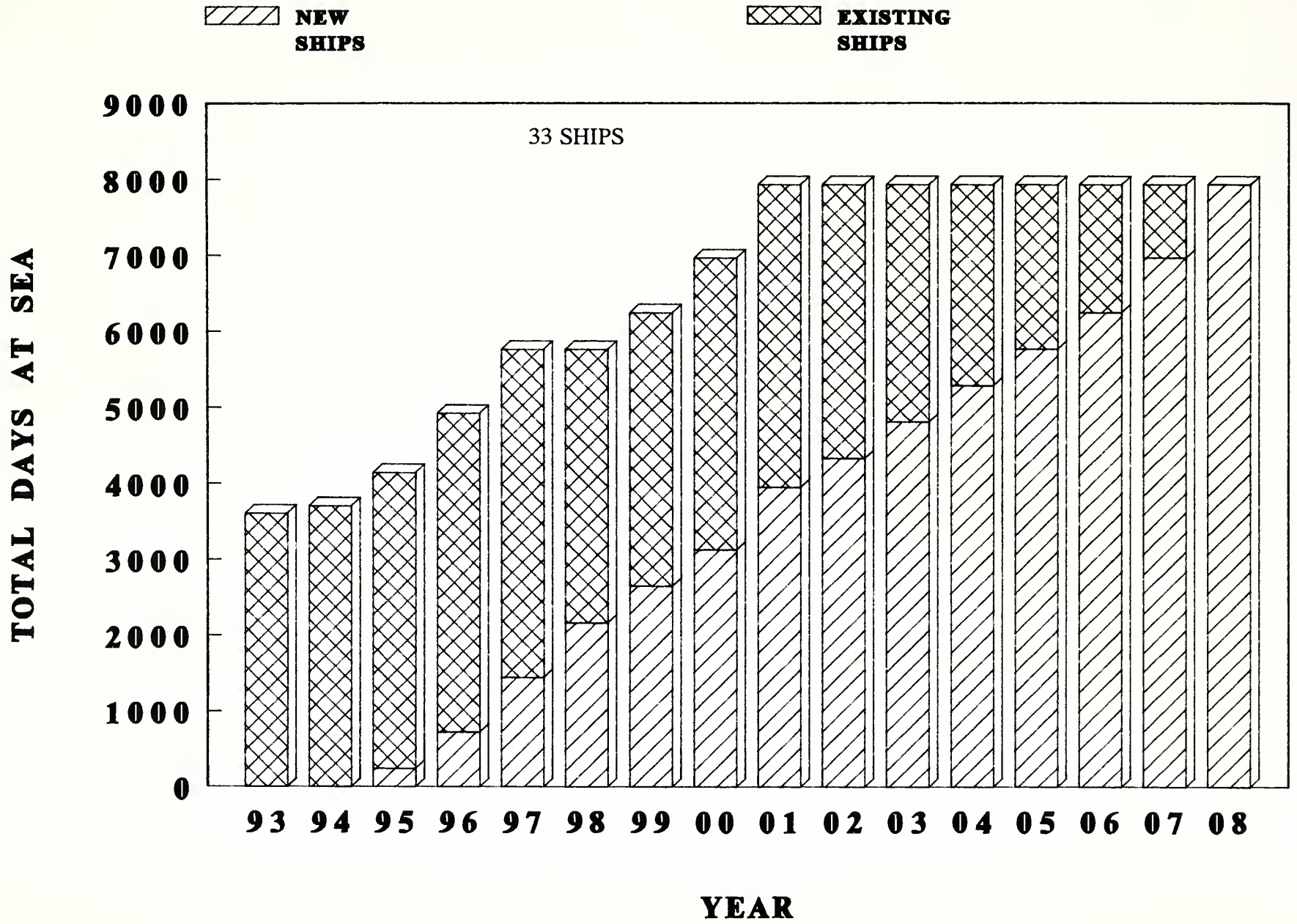
* KEY TO SHIP ABBREVIATIONS APPEARS ON P. A25.

NOTES: (1) AFTER REPLACEMENT VESSEL COMES ON LINE, DISCOVERER HAS SERVICE-LIFE EXTENSION AND PERFORMS NEW CHARTING MISSION REQUIREMENTS.

(2) OSV IMMEDIATELY REPLACES DEACTIVE ALBATROSS IV.

(3) AFTER OREGON REPLACEMENT COMES ON LINE, OREGON HAS SERVICE-LIFE EXTENSION AND PERFORMS NEW MISSION.

TOTAL FLEET DAYS AT SEA
PLANNING LEVEL B



PLANNING LEVEL B
NEW CONSTRUCTION
COSTS IN 1990 DOLLARS (MILLIONS)

ACTIVITY	FY1993	FY94	FY95	FY96	FY97	FY98	FY99	FY2000	FY01	FY02	FY03	FY04	FY05	FY06	FY07	TOTALS
Service life extension	17.5	23.0	20.0	10.0	0.0	5.5	6.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	82.0
Conversions	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Replacement vessels	68.0	73.0	38.0	53.0	0.0	0.0	83.0	71.0	64.0	73.0	70.0	23.0	46.0	0.0	0.0	662.0
New requirements	0.0	0.0	32.0	13.0	79.0	65.0	0.0	0.0	0.0	0.0	0.0	43.0	23.0	23.0	0.0	278.0
New operating costs	0.0	11.0	12.5	13.0	18.3	21.3	22.6	27.6	32.9	32.9	32.9	32.9	32.9	32.9	36.9	360.6
Charter/purchase	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Project costs	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	0.5	17.3
Commissioning/ changing orders	0.0	0.0	8.2	8.8	8.0	7.6	9.2	8.5	9.2	8.5	8.4	8.0	7.7	8.4	0.0	100.5
TOTAL	**86.7**	**108.2**	**111.9**	**99.0**	**106.5**	**100.6**	**122.0**	**108.3**	**107.3**	**115.6**	**112.5**	**108.1**	**110.8**	**65.5**	**37.4**	**1500.4**

GRAND TOTAL $1500.4

Planning Level B – Construct 26, Charter 7

Preliminary Transition Plan

Establishes a 26–NOAA–owned–ship fleet which:
- Replaces 20 existing ships
- Adds 6 new ships.

7 ships are potential charter/contract (1620 DAS) with:
- 2 high–endurance ships––
  - Charting at 240 DAS
  - LMR at 180 DAS
- 2 medium–endurance ships––
  - Charting at 240 DAS
  - LMR at 240 DAS
- 2 coastal/low endurance ships––
  - Charting at 240 DAS
  - LMR at 240 DAS
- 1 nearshore/estuarine ship––
  - Oceanography at 240 DAS

Ship operations increased to 240 DAS upon completion of service–life extension or replacement.

Construction/replacement is completed in 15 years with an average cost of $97 million per year and a total cost of $1,455 million.

*Transition Plan Highlights**

PHASE I
FY 1993 – FY 1997

3 ships replaced (DI, TC, OR)
2 ships reactivated (OC, FA)
1 ship conversion (AL)
10 ships service–life extended (FA, RA, MI, MF, MB, WH, DA, AR, DS, DE)
7 ships on charter/contract (SU, PE, new requirements)
2 ships constructed for new requirements
Construction started on 3 replacement/new ships
Ship operations increased from 3600 to 6524 DAS

Cost $487.3M

PHASE II
FY 1998 – 2002

5 ships replaced (OC, FA, MF, WH, FE)
2 ships service–life extended (CH, OR)
7 ships on charter/contract (SU, PE, new requirements)
3 ships constructed for new requirements
Construction started on 4 replacement ships
Ship operations increased from 6524 to 7910 DAS

Cost $560.4M

PHASE III
FY 2003 – 2007

9 ships replaced (RA, MI, MB, DA, AR, DS, DE, CH, AL conversion)
7 ships on charter/contract (SU, PE, new requirements)
1 ship constructed for new requirements

Cost $407.3M

TOTAL COST **$1,455.0M**

* Key to Ship Abbreviations appears on p. A25.

NUMBER AND MIX OF SHIPS
7910 DAS*

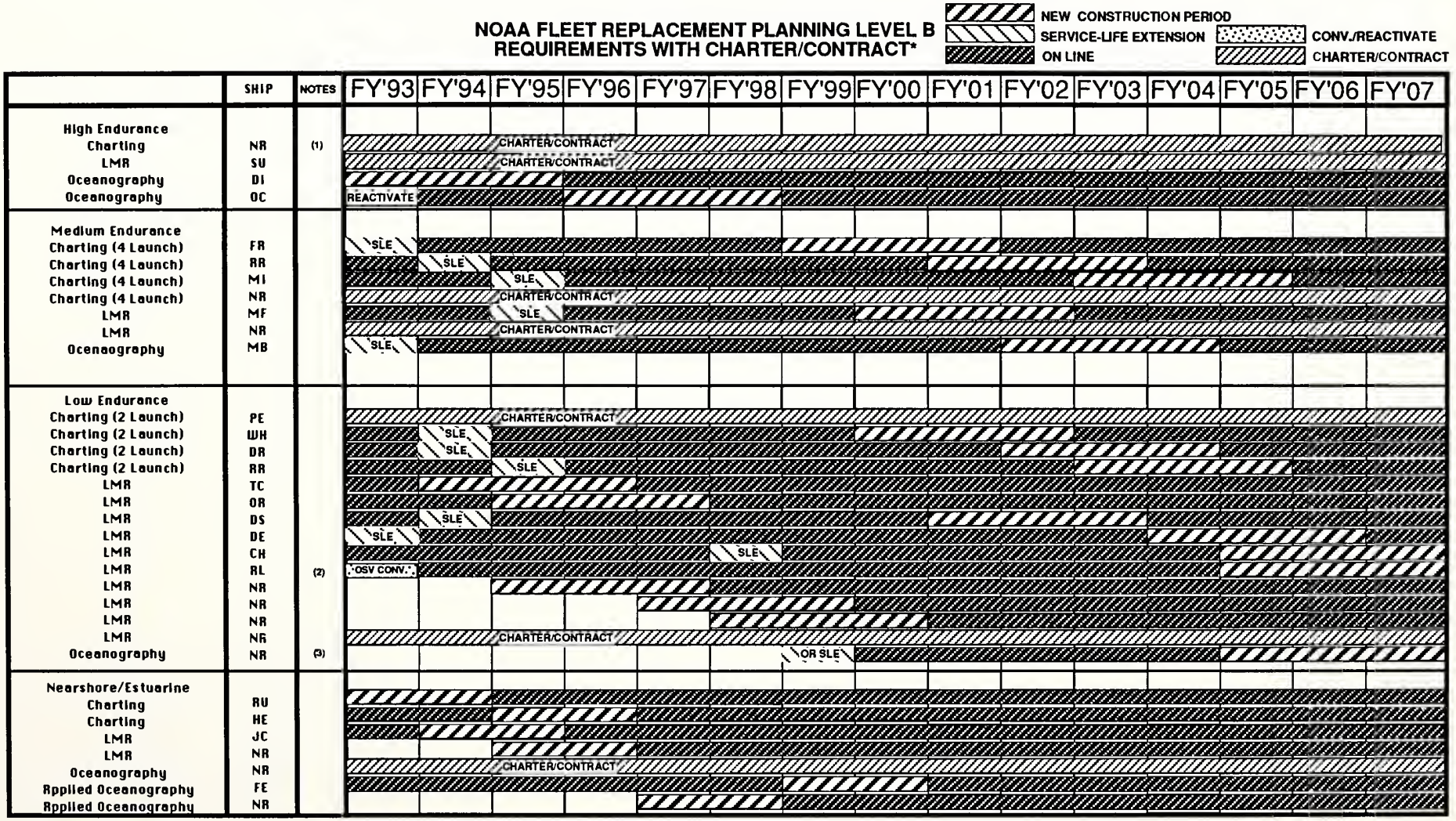
	CHARTING	LIVING MARINE RESOURCES	OCEANOGRAPHY	TOTAL
High Endurance	1.0**	0.8**	2.3	4.1
Medium Endurance	3.0 1.0**	1.0 1.0**	1.1	7.1
Low Endurance	3.0 1.0**	8.7 1.0**	1.2	14.9
Nearshore/Estuarine	2.0	2.0	2.0 0.9**	6.9
TOTAL	**11.0**	**14.5**	**7.5**	**33.0**

* 240 DAS per ship ** Charter/contract

15–YEAR COST SUMMARY

ACTIVITY	COST ($M)
Service–Life Extension/Conversion – 13 ships	$ 78.0
New Ship Construction – 26 ships	737.0
Support Cost (operating, project, commissioning, change orders)	280.0
Charter/Contract – 7 ships	360.0
15–YEAR TOTAL	**$1,455.0**

NOAA FLEET REPLACEMENT PLANNING LEVEL B REQUIREMENTS WITH CHARTER/CONTRACT*



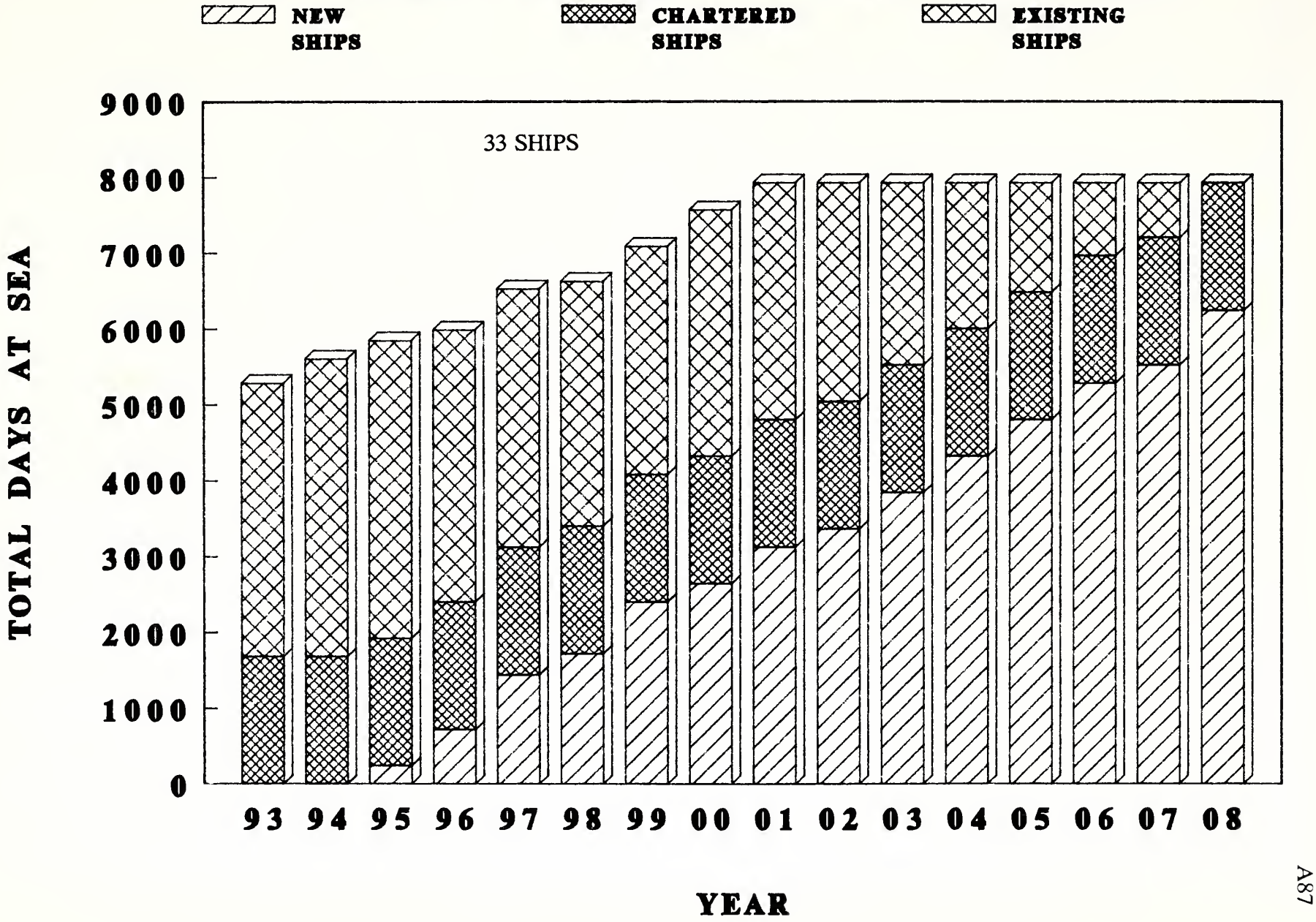
* KEY TO SHIP ABBREVIATIONS APPEARS ON P. A25.

NOTES: (1) AFTER REPLACEMENT VESSEL COMES ON LINE, DISCOVERER HAS SERVICE-LIFE EXTENSION AND PERFORMS NEW CHARTING MISSION REQUIREMENTS.

(2) OSV IMMEDIATELY REPLACES DEACTIVE ALBATROSS IV.

(3) AFTER OREGON REPLACEMENT COMES ON LINE, OREGON HAS SERVICE-LIFE EXTENSION AND PERFORMS NEW MISSION.

TOTAL FLEET DAYS AT SEA
PLANNING LEVEL B WITH CHARTER/CONTRACT



PLANNING LEVEL B
NEW CONSTRUCTION/CHARTER
COSTS IN 1990 DOLLARS (MILLIONS)

ACTIVITY	FY1993	FY94	FY95	FY96	FY97	FY98	FY99	FY2000	FY01	FY02	FY03	FY04	FY05	FY06	FY07	TOTALS
Service life extension	13.5	23.0	20.0	10.0	0.0	5.5	6.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	78.0
Conversions	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Replacement vessels	68.0	32.0	38.0	53.0	0.0	0.0	83.0	71.0	64.0	73.0	70.0	23.0	46.0	0.0	0.0	621.0
New requirements	0.0	0.0	32.0	0.0	38.0	23.0	0.0	0.0	0.0	0.0	0.0	0.0	23.0	0.0	0.0	116.0
New operating costs	-6.0	3.0	4.5	1.0	6.3	8.3	9.0	13.6	17.5	17.5	17.5	17.5	17.5	17.5	17.5	162.2
Charter/purchase	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	360.0
Project costs	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	0.5	17.3
Commissioning/ changing orders	0.0	0.0	8.2	8.8	8.0	7.6	9.2	8.5	9.2	8.5	8.4	8.0	7.7	8.4	0.0	100.5
TOTAL	**100.7**	**83.2**	**127.9**	**98.0**	**77.5**	**69.6**	**132.4**	**118.3**	**115.9**	**124.2**	**121.1**	**73.7**	**119.4**	**51.1**	**42.0**	**1455.0**

GRAND TOTAL $1455.0

Planning Level B – Construct 31 (300 DAS)

Preliminary Transition Plan

Establishes a 31–NOAA–owned–ship fleet which:
- Replaces 21 existing ships
- Adds 10 new ships.

High– and medium–endurance ships are increased to 300 DAS after replacement.

Low–endurance and nearshore/estuarine ships operate at 240 DAS after service–life extension or replacement.

Reduces the requirement for one high–endurance and one medium–endurance ship from the 240 DAS level.

Operating and maintenance costs for high– and medium–endurance ships are increased to reflect 300 DAS operations.

Construction/replacement program is completed in 15 years with an average cost of $94 million per year and a total cost of $1,406 million.

*Transition Plan Highlights**

PHASE I
FY 1993 – FY 1997

7 ships replaced (SU, OC, TC, OR, RU, HE, JC)
3 ships reactivated (OC, FA, PE)
1 ship conversion (AL)
10 ships service-life extended (DI, RA, MI, MF, WH, DA, AR, DS, DE, FE)
2 ships constructed for new requirements
Construction started on 5 replacement/new ships
Ship operations increased from 3600 to 5300 DAS

Cost $510.8M

PHASE II
FY 1998 – FY 2002

8 ships replaced (FA, MB, PE, WH, DS, DE, CH, FE)
7 ships constructed for new requirements
Construction started on 2 replacement ships
Ship operations increased from 5300 to 7910 DAS

Cost $575.8M

PHASE III
FY 2003 – 2007

7 ships replaced (DI, RA, MI, MF, DA, AR, AL conversion)

Cost $319.7M

TOTAL COST **$1406.3M**

* Key to Ship Abbreviations appears on p. A25.

NUMBER AND MIX OF SHIPS
7910 DAS*

	CHARTING	LIVING MARINE RESOURCES	OCEANOGRAPHY	TOTAL
High Endurance	1.0	1.0	1.0	3.0
Medium Endurance	3.0	2.0	1.0	6.0
Low Endurance	4.0	10.0	1.0	15.0
Nearshore/Estuarine	2.0	2.0	3.0	7.0
TOTAL	**10.0**	**15.0**	**6.0**	**31.0**

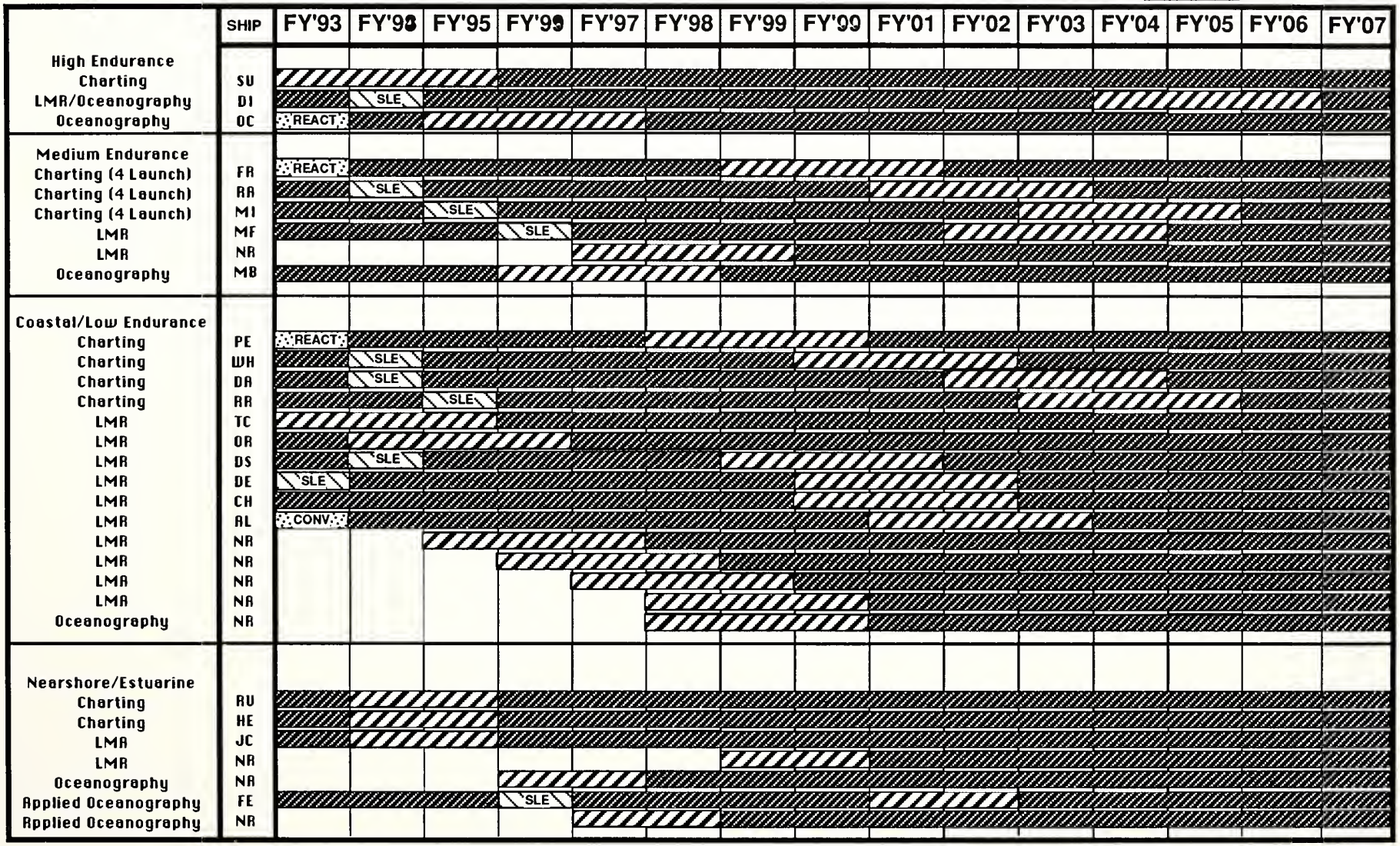
* 300 DAS per ship

15–YEAR COST SUMMARY

ACTIVITY	COST ($M)
Service–Life Extension/Conversion – 12 ships	$ 72.5
New Ship Construction – 31 ships	865.0
Support Cost (operating, project, commissioning, change orders)	468.8
15–YEAR TOTAL	**$1406.3**

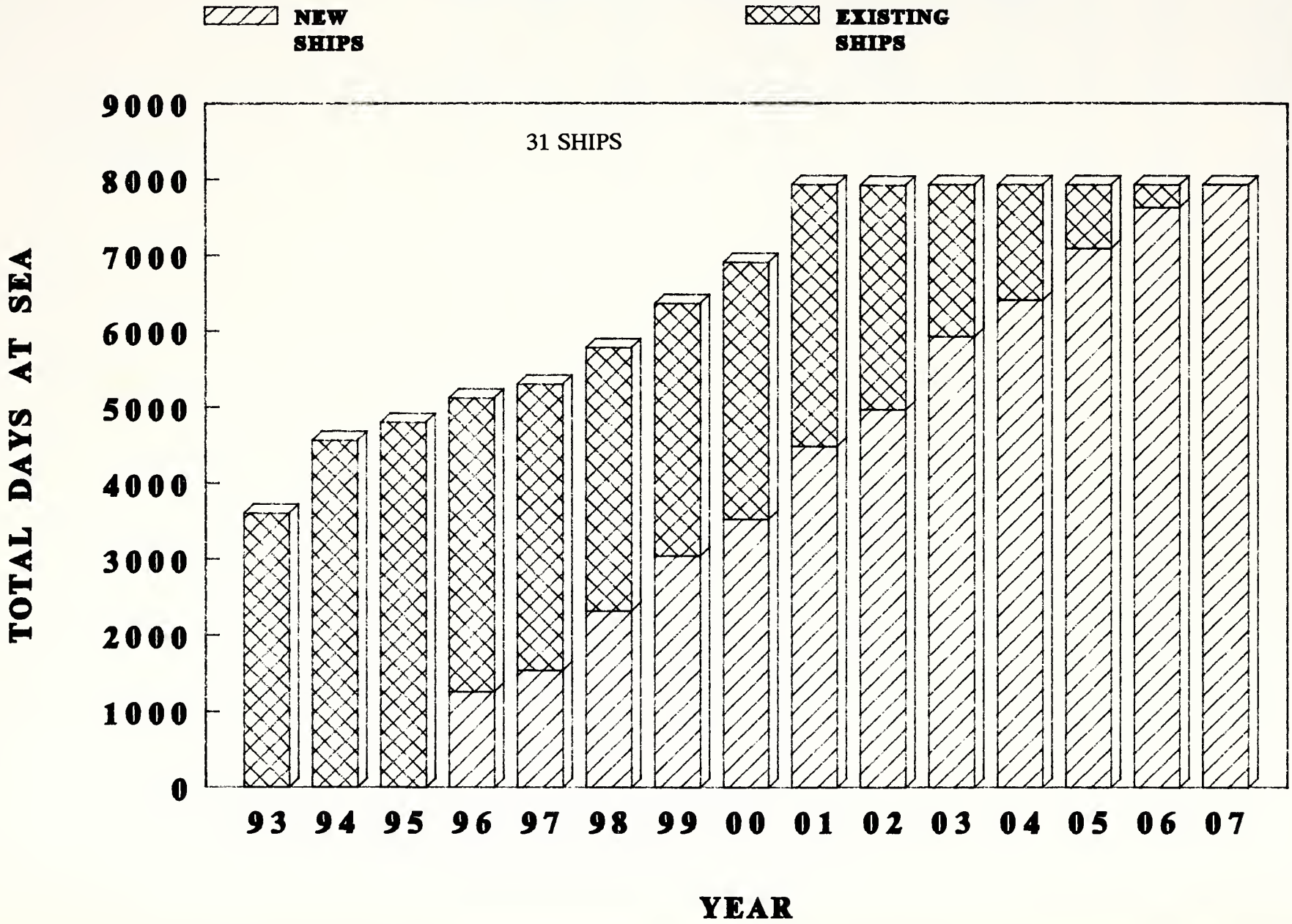
NOAA FLEET REPLACEMENT
PLANNING LEVEL B REQUIREMENT (300)
HIGH AND MEDIUM ENDURANCE @ 300 DAS*

NEW CONSTRUCTION PERIOD
SERVICE-LIFE EXTENSION
ON LINE
CONV./REACTIVATE



* KEY TO SHIP ABBREVIATIONS APPEARS ON P. A25.

TOTAL FLEET DAYS AT SEA
PLANNING LEVEL B – 300 DAS



PLANNING LEVEL B (300 DAS)
NEW CONSTRUCTION
COSTS IN 1990 DOLLARS (MILLIONS)

ACTIVITY	FY1993	FY94	FY95	FY96	FY97	FY98	FY99	FY2000	FY01	FY02	FY03	FY04	FY05	FY06	FY07	TOTALS
Service life extension	17.0	28.0	9.0	7.0	0.0	5.5	6.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	72.5
Conversions	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Replacement vessels	66.0	62.0	53.0	44.0	0.0	29.0	64.0	75.0	77.0	73.0	70.0	53.0	0.0	0.0	0.0	666.0
New requirements	0.0	0.0	23.0	36.0	80.0	51.0	9.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	199.0
New operating costs	0.0	11.0	12.5	13.0	18.3	21.3	22.6	27.6	32.9	32.9	32.9	32.9	32.9	32.9	36.9	360.6
Charter/purchase	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Project costs	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	0.5	0.0	16.1
Commissioning/ changing orders	0.0	0.0	8.2	8.8	8.0	7.6	9.2	8.5	9.2	8.5	8.4	8.0	7.7	0.0	0.0	92.1
TOTAL	**84.2**	**102.2**	**106.9**	**110.0**	**107.5**	**115.6**	**112.0**	**112.3**	**120.3**	**115.6**	**112.5**	**95.1**	**41.8**	**33.4**	**36.9**	**1406.3**

GRAND TOTAL $1406.3

Planning Level B – Construct 24, Charter 7 (300 DAS)

Preliminary Transition Plan

Establishes a 24–NOAA–owned–ship fleet which:
Replaces 18 existing ships
Adds 6 new ships.

7 ships are potential charter/contract (1740 DAS) with:

2 high–endurance ships––
Charting at 240 DAS
LMR at 180 DAS

2 low–endurance ships––
Charting at 240 DAS
LMR at 240 DAS

2 medium endurance ships––
Charting at 300 DAS
LMR at 300 DAS

1 nearshore/estuarine ship––
Oceanography at 240 DAS

High– and medium–endurance ships are increased to 300 DAS per year after replacement.

Low–endurance and nearshore/estuarine ships operate at 240 DAS per year after service–life extension or replacement.

Operating and maintenance costs for high– and medium–endurance ships are increased to reflect 300 DAS.

Construction/replacement/charter program will be completed in 15 years and has an average cost of $95 million per year and a total cost of $1,426 million.

*Transition Plan Highlights**

PHASE I
FY 1993 – FY 1997

5 ships replaced (TC, OR, RU, HE, JC)
1 ship reactivated (FA)
1 ship conversion (AL)
9 ships service–life extended (DI, RA, MF, WH, DA, AR, DS, DE, FE)
1 ship out–of–service (OC)
1 ship constructed for new requirements
7 ships on charter/contract (SU, MI, PE, new requirements)
Construction started on 4 replacement/new ships
Ship operations increased from 3600 to 5300 DAS

Cost $510.3M

PHASE II
FY 1998 – 2002

7 ships replaced (FA, MB, WH, DS, DE, CH, FE)
1 ship out–of–service (OC)
5 ships constructed for new requirements
Construction started on 3 replacement ships
7 ships on charter/contract (SU, MI, PE, new requirements)
Ship operations increased from 5300 to 7910 DAS

Cost $617.0M

PHASE III
FY 2003 – 2007

6 ships replaced (DI, RA, MF, DA, AR, AL conversion)
1 ship out–of–service (OC)
7 ships on charter/contract (SU, MI, PE, new requirements)

Cost $299.0M

TOTAL COST **$1,426.3M**

* Key to Ship Abbreviations appears on p. A25.

NUMBER AND MIX OF SHIPS
7910 DAS*

	CHARTING	LIVING MARINE RESOURCES	OCEANOGRAPHY	TOTAL
High endurance	1.0**	1.0**	1.0	3.0
Medium endurance	2.0 1.0**	1.0 1.0**	1.0	6.0
Low endurance	3.0 1.0**	9.0 1.0**	1.0	15.0
Nearshore/Estuarine	2.0	2.0	2.0 1.0**	7.0
TOTAL	**10.0**	**15.0**	**6.0**	**31.0**

* High– and Medium–Endurance at 300 DAS
Low–Endurance and Nearshore/Estuarine at 240 DAS

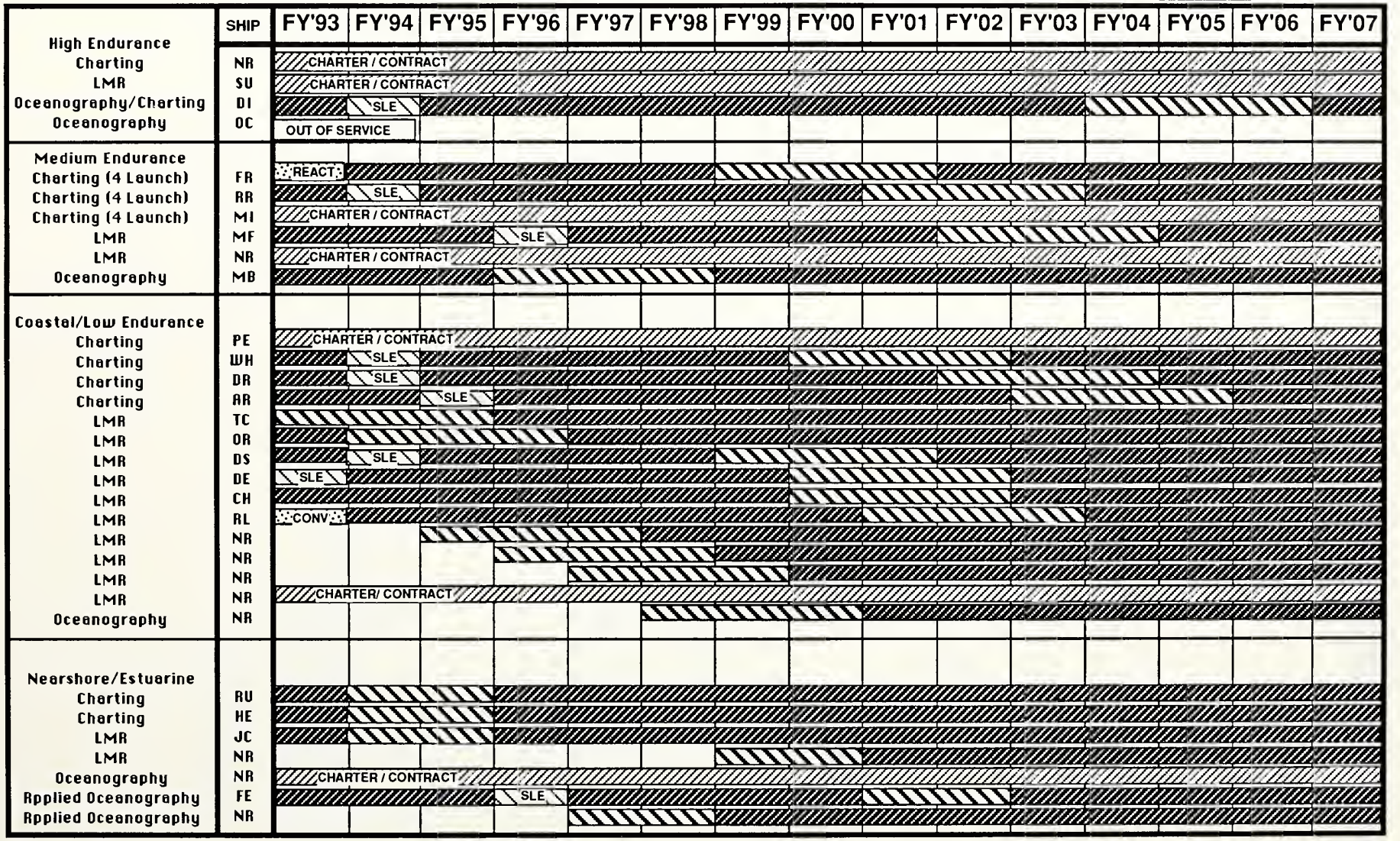
** Charter/contract

15–YEAR COST SUMMARY

ACTIVITY	COST ($M)
Service–Life Extension/Conversion – 10 ships	$ 69.0
New Ship Construction – 26 ships	682.0
Support Cost (operating, project, commissioning, change orders)	345.3
Charter/Contract – 7 ships	330.0
15–YEAR TOTAL	**$1,426.3**

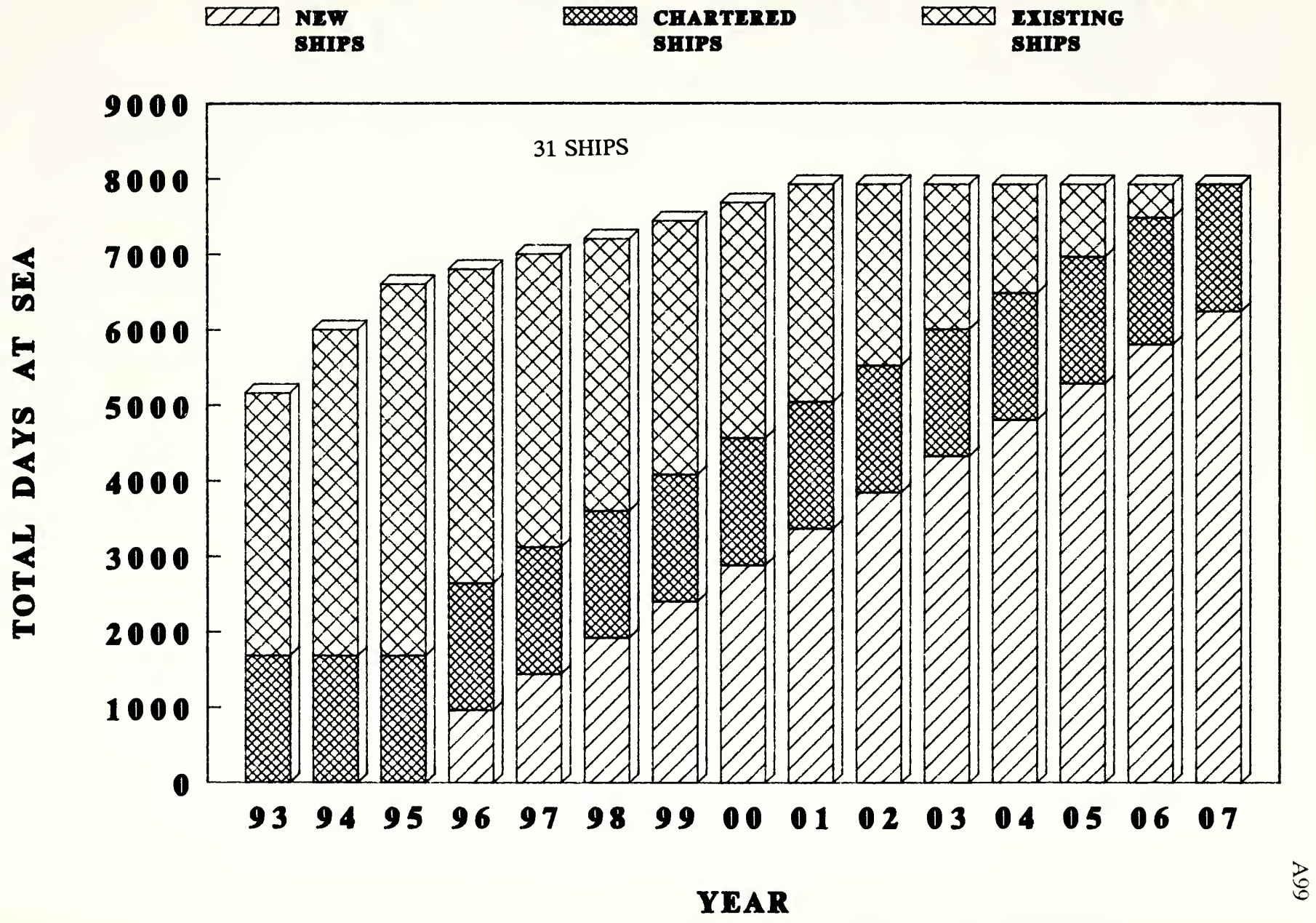
NOAA FLEET REPLACEMENT PLANNING LEVEL B
REQUIREMENT (300) CHARTER/CONTRACT
HIGH AND MEDIUM ENDURANCE @ 300 DAS*

NEW CONSTRUCTION PERIOD
SERVICE-LIFE EXTENSION
CONV./REACTIVATE
ON LINE
CHARTER/CONTRACT



* KEY TO SHIP ABBREVIATIONS APPEARS ON P. A25.

TOTAL FLEET DAYS AT SEA
PLANNING LEVEL B - 300 DAS WITH CHARTER



PLANNING LEVEL B (300 DAS)
CHARTER
COSTS IN 1990 DOLLARS (MILLIONS)

ACTIVITY	FY1993	FY94	FY95	FY96	FY97	FY98	FY99	FY2000	FY01	FY02	FY03	FY04	FY05	FY06	FY07	TOTALS
Service life extension	17.5	28.0	5.0	7.0	0.0	5.5	6.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	69.0
Conversions	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Replacement vessels	13.0	62.0	53.0	44.0	0.0	29.0	64.0	75.0	77.0	73.0	70.0	0.0	0.0	0.0	0.0	560.0
New requirements	0.0	0.0	23.0	23.0	39.0	28.0	9.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	122.0
New operating costs	0.0	11.0	12.5	13.0	18.3	18.3	18.3	18.3	18.3	18.3	18.3	18.3	18.3	18.3	18.3	237.8
Charter/purchase	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	330.0
Project costs	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	0.5	0.5	0.0	15.4
Commissioning/ changing orders	0.0	0.0	8.2	8.8	8.0	7.6	9.2	8.5	9.2	8.5	8.4	8.0	7.7	0.0	0.0	92.1
TOTAL	**53.7**	**124.2**	**124.9**	**119.0**	**88.5**	**111.6**	**129.7**	**125.0**	**127.7**	**123.0**	**119.9**	**49.5**	**48.5**	**40.8**	**40.3**	**1426.3**

GRAND TOTAL $1426.3

Planning Level C

Construct 43
Construct 36, Charter 7

Planning Level C – Construct 43

Preliminary Transition Plan

Establishes a 43–NOAA–owned–ship fleet which:
- Replaces 22 existing ships
- Adds 21 new ships.

Deactivated ships are placed back in service to increase DAS.

Ships in poor material condition and/or functionality are replaced early.

Ships to meet new requirements are constructed early in schedule.

Existing ships are repaired to extend service life for the transition period.

OREGON II supports low–endurance oceanographic new requirement starting in 1998.

Ship operations are increased to 240 DAS upon completion of service–life extension or replacement.

Construction/replacement program is completed in 15 years with an average cost of $128 million per year and a total cost of $1,918 million.

*Transition Plan Highlights**

PHASE I
FY 1993 – FY 1997

6 ships replaced (SU, TC, OR, RU, HE, JC)
3 ships reactivated (OC, FA, PE)
1 ship conversion (AL)
11 ships service–life extended (FA, RA, MI, MF, MB, PE, WH, DA, DS, DE, FE)
5 ships constructed for new requirements
Construction started on 6 replacement/new ships
Ship operations increased from 3600 to 6240 DAS

Cost $613.5M

PHASE II
FY 1998 – FY 2002

8 ships replaced (DI, OC, PE, AR, DS, DE, CH, FE)
1 ship service–life extended (OR)
16 ships constructed for new requirements
Construction started on 6 replacement/new ships
Ship operations increased from 6240 to 9360 DAS

Cost $698.9M

PHASE III
FY 2003 – FY 2007

10 ships replaced (FA, RA, MI, MF, MB, WH, DA, DS, DE, AL conversion)
5 ships constructed for new requirements

Cost $605.9M

TOTAL COST **$1,918.3M**

* Key to Ship Abbreviations appears on p. A25.

NUMBER AND MIX OF SHIPS
10,215 DAS*

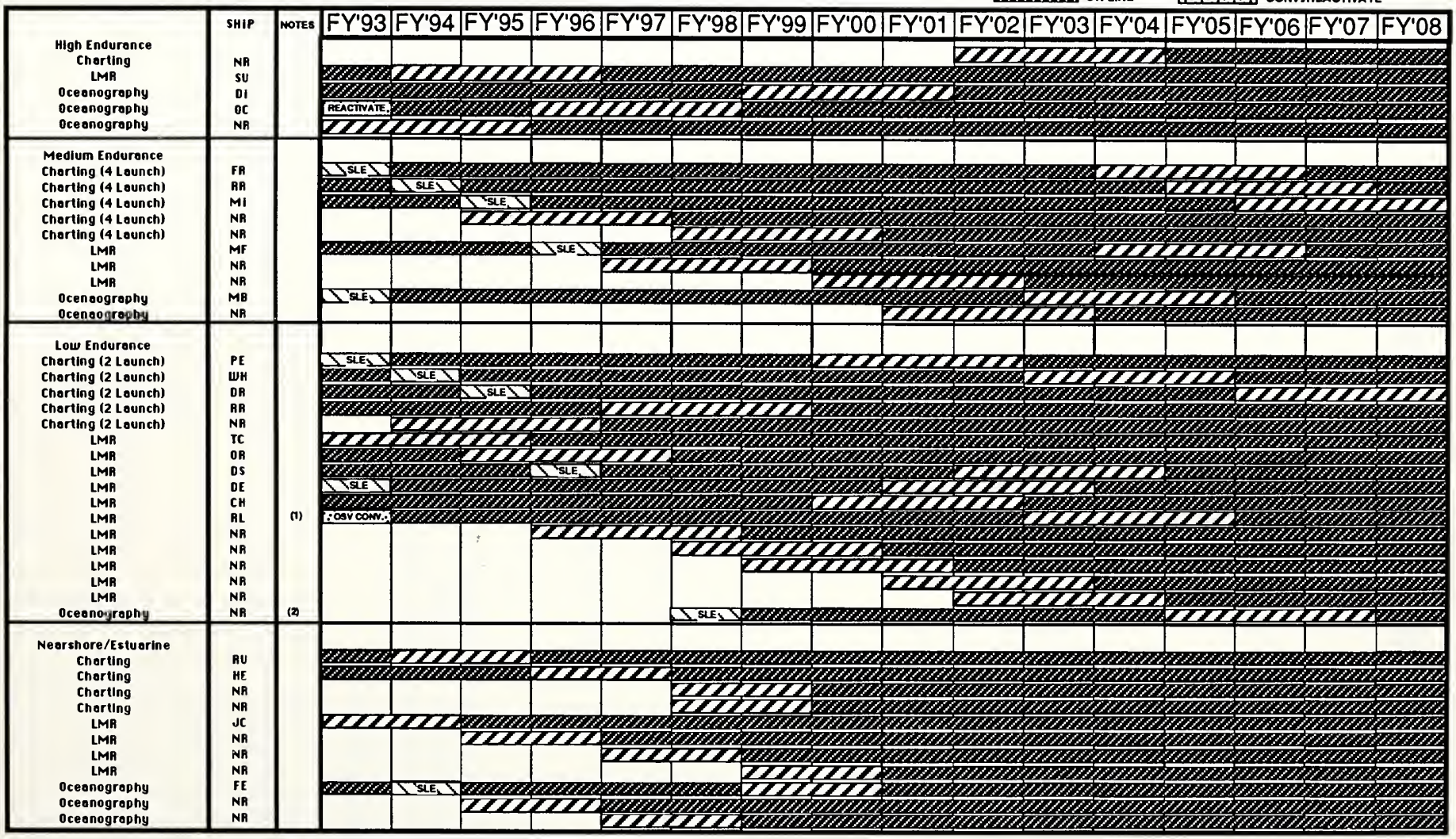
	CHARTING	LIVING MARINE RESOURCES	OCEANOGRAPHY	TOTAL
High Endurance	1.0	0.8	2.9	4.7
Medium Endurance	5.0	3.0	1.4	9.4
Low Endurance	5.0	11.3	1.5	17.8
Nearshore/Estuarine	4.0	4.0	3.1	11.1
TOTAL	**15.0**	**19.1**	**8.9**	**43.0**

* 240 DAS per ship

15–YEAR COST SUMMARY

ACTIVITY	COST ($M)
Service–Life Extension/Conversion – 13 ships	$ 81.0
New Ship Construction – 43 ships	1223.0
Support Cost (operating, project, commissioning, change orders)	614.3
15–YEAR TOTAL	**$1918.3**

NOAA FLEET REPLACEMENT PLANNING LEVEL C REQUIREMENTS*

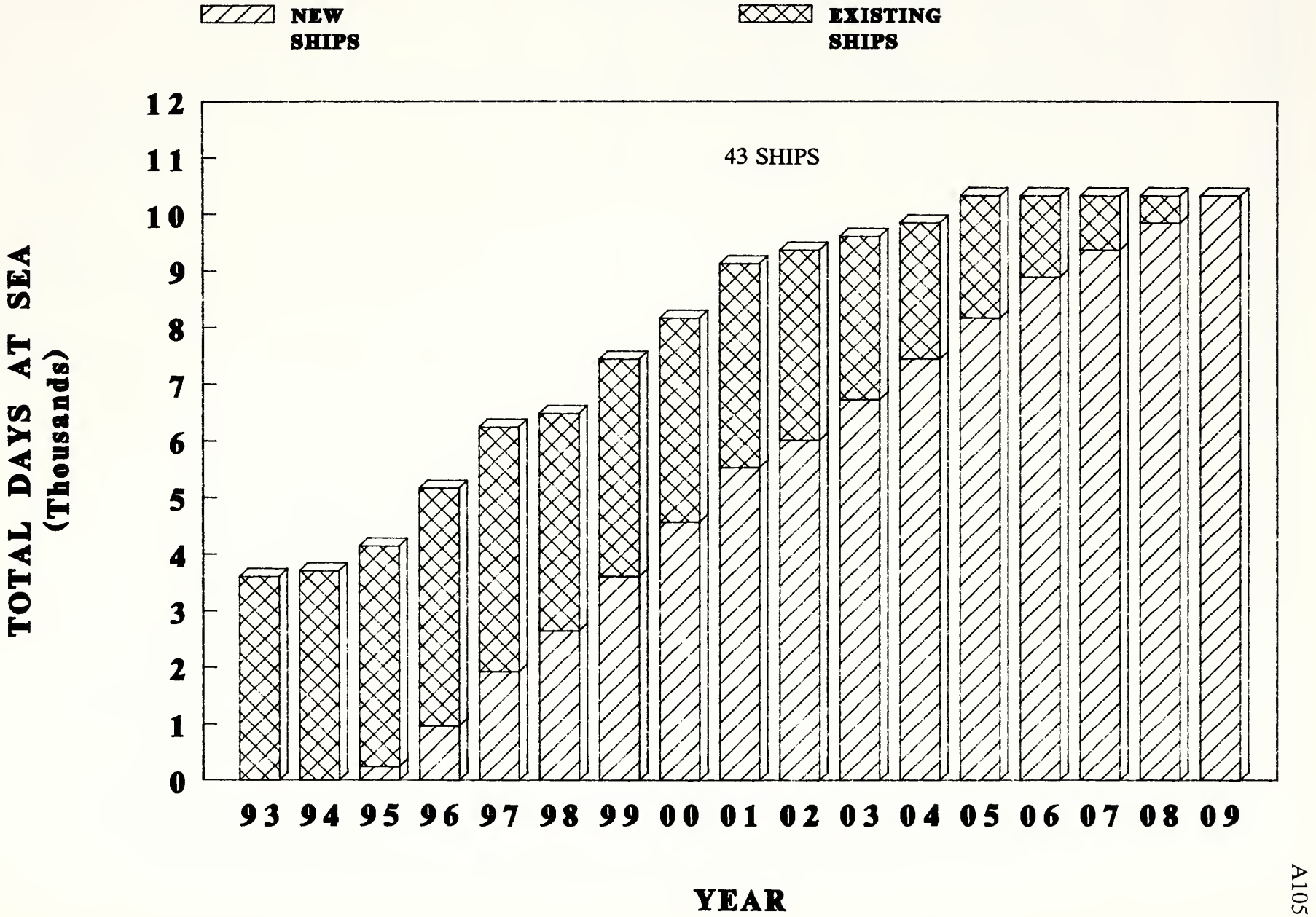


* KEY TO SHIP ABBREVIATIONS APPEARS ON P. A25.

NOTES: (1) OSV IMMEDIATELY REPLACES DEACTIVEATED ALBATROSS IV

(2) AFTER OREGON REPLACEMENT COMES ON LINE, OREGON HAS SERVICE-LIFE EXTENSION AND PERFORMS NEW OCEANOGRAPHIC MISSION REQUIREMENTS.

TOTAL FLEET DAYS AT SEA
PLANNING LEVEL C



PLANNING LEVEL C
NEW CONSTRUCTION
COSTS IN 1990 DOLLARS (MILLIONS)

ACTIVITY	FY1993	FY94	FY95	FY96	FY97	FY98	FY99	FY2000	FY01	FY02	FY03	FY04	FY05	FY06	FY07	TOTALS
Service life extension	25.0	18.0	17.0	16.0	0.0	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	81.0
Conversions	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Replacement vessels	32.0	56.0	23.0	68.0	29.0	0.0	66.0	52.0	23.0	23.0	96.0	83.0	41.0	70.0	0.0	662.0
New requirements	53.0	29.0	63.0	23.0	64.0	94.0	32.0	42.0	67.0	66.0	0.0	0.0	28.0	0.0	0.0	561.0
New operating costs	2.0	9.6	10.5	15.4	20.3	23.6	27.6	32.6	38.6	40.6	43.6	48.6	44.5	44.5	44.5	446.5
Charter/purchase	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Project costs	1.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	1.5	0.5	27.0
Commissioning/ changing orders	0.0	0.0	10.2	10.2	10.3	10.9	10.1	11.3	11.8	11.8	11.2	10.8	10.7	11.5	10.0	140.8
TOTAL	**113.0**	**114.6**	**125.7**	**134.6**	**125.6**	**135.5**	**137.7**	**139.9**	**142.4**	**143.4**	**152.8**	**144.4**	**126.2**	**127.5**	**55.0**	**1918.3**

GRAND TOTAL $1918.3

Planning Level C – Construct 36, Charter 7

Preliminary Transition Plan

Establishes a 36–NOAA–owned–ship fleet which:
- Replaces 21 existing ships
- Adds 15 new ships.

7 ships are potential charter/contract with:

2 high–endurance ships––
- Charting at 240 DAS
- LMR at 180 DAS

2 medium–endurance ships––
- Charting at 240 DAS
- LMR at 240 DAS

2 coastal/low–endurance ships––
- Charting at 240 DAS
- LMR at 240 DAS

1 nearshore/estuarine ship––
- Oceanography at 240 DAS

Ship operations are increased to 240 DAS upon completion of service–life extension or replacement.

Construction/replacement program is completed in 15 years with an average cost of $123 million per year and a total cost of $1,837 million.

*Transition Plan Highlights**

PHASE I
FY 1993 – FY 1997

5 ships replaced (TC, OR, RU, HE, JC)
1 ship reactivated (OC)
1 ship conversion (AL)
11 ships service–life extended (FA, RA, MI, MF, MB, PE, WH, DA, DS, DE, FE)
7 ships on charter/contract (SU, new requirements)
4 ships constructed for new requirements
Construction started on 6 replacement/new ships
Ship operations increased from 3600 to 6864 DAS

Cost	$580.2M

PHASE II
FY 1998 – 2002

5 ships replaced (DI, OC, PE, AR, FE)
1 ship service–life extended (OR)
7 ships on charter/contract (SU, new requirements)
7 ships constructed for new requirements
Construction started on 4 replacement/new ships
Ship operations increased from 6864 to 9840 DAS

Cost	$641.9M

PHASE III
FY 2003 – 2007

9 ships replaced (FA, RA, MI, MB, WH, DA, DS, DE, AL conversion)
7 ships on charter/contract (SU, new requirements)
4 ships constructed for new requirements

Cost	$614.7M
TOTAL COST	**$1,836.8M**

* Key to Ship Abbreviations appears on p. A25.

NUMBER AND MIX OF SHIPS
10,215 DAS*

	CHARTING	LIVING MARINE RESOURCES	OCEANOGRAPHY	TOTAL
High Endurance	1.0**	0.8**	2.9	4.7
Medium Endurance	4.0 1.0**	2.0 1.0**	1.4	9.4
Low Endurance	4.0 1.0**	10.3 1.0**	1.5	17.8
Nearshore/Estuarine	4.0	4.0	2.0 1.1**	11.1
TOTAL	**15.0**	**19.1**	**8.9**	**43.0**

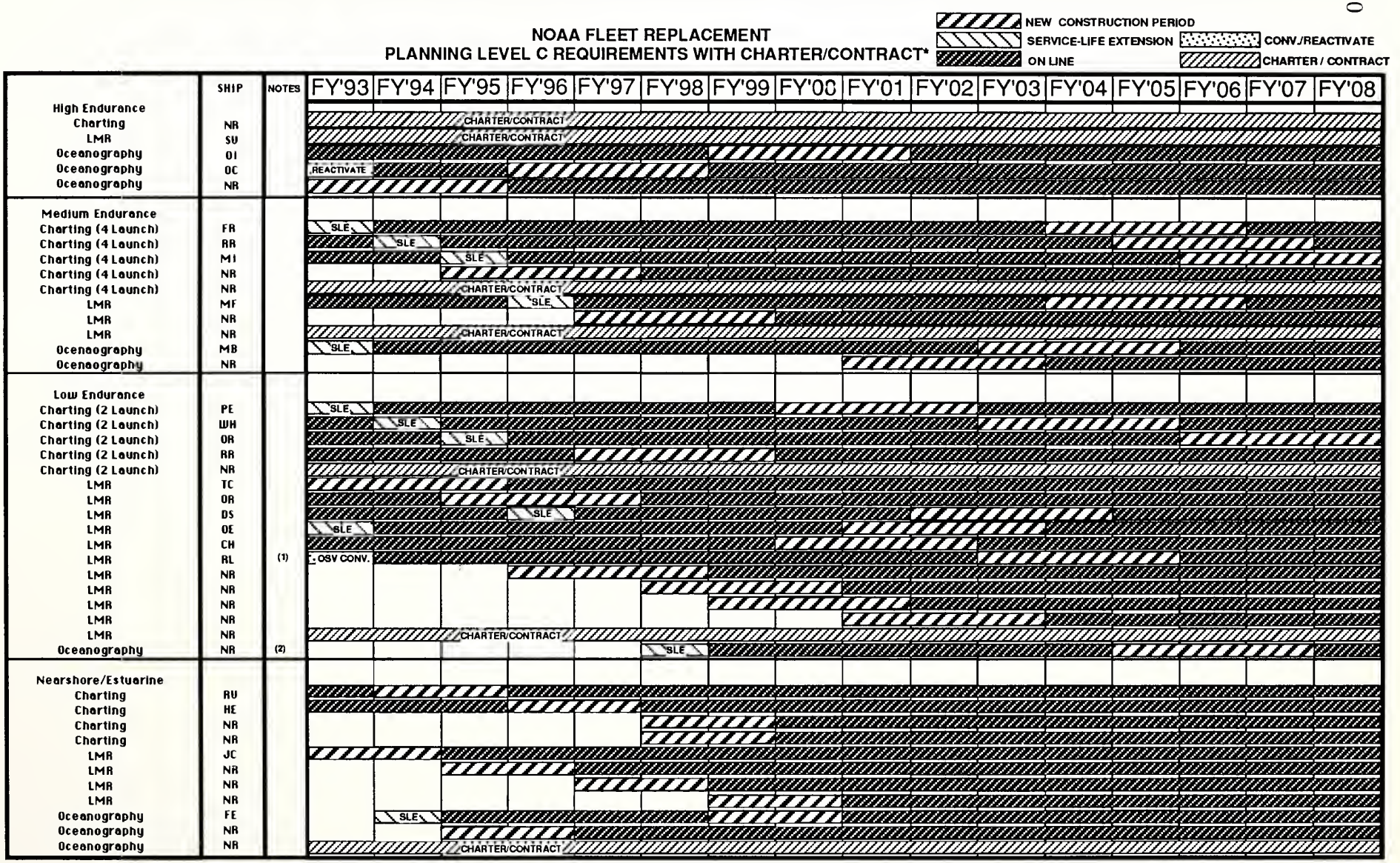
* 240 DAS per ship

** Charter/contract

15–YEAR COST SUMMARY

ACTIVITY	COST ($M)
Servuce–Life Extension/Conversion – 12 ships	$ 81.0
New Ship Construction – 36 ships	992.0
Support Cost (operating, project, commissioning, change orders)	433.8
Charter/Contract – 7 ships	330.0
15–YEAR TOTAL	**$1,836.8**

NOAA FLEET REPLACEMENT
PLANNING LEVEL C REQUIREMENTS WITH CHARTER/CONTRACT*

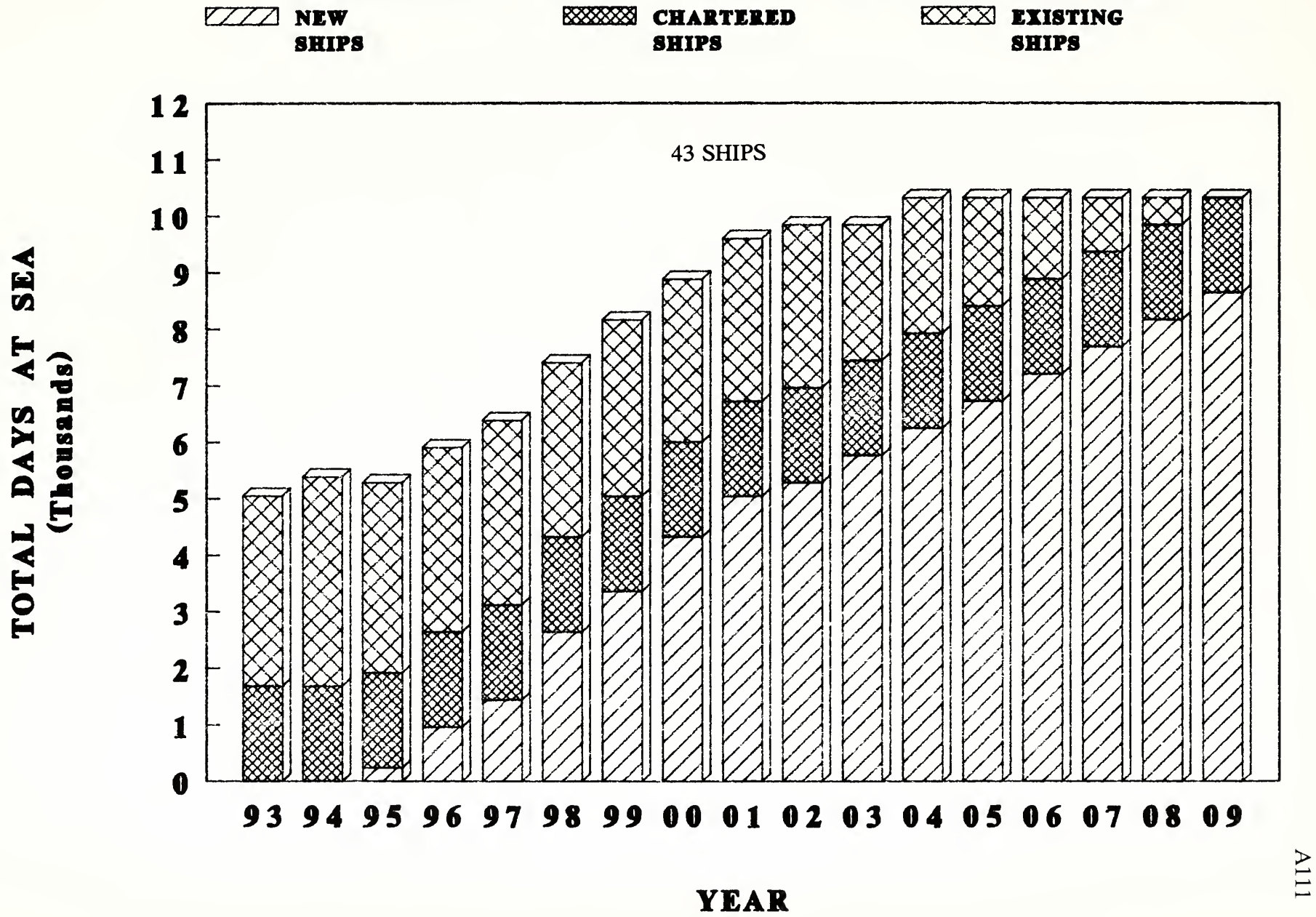


* KEY TO SHIP ABBREVIATIONS APPEARS ON P. A25.

NOTES: (1) OSV IMMEDIATELY REPLACES DEACTIVE ALBATROSS IV

(2) AFTER OREGON REPLACEMENT COMES ON LINE, OREGON HAS SERVICE-LIFE EXTENSION AND PERFORMS NEW OCEANOGRAPHIC MISSION REQUIREMENTS.

TOTAL FLEET DAYS AT SEA
PLANNING LEVEL C WITH CHARTER/CONTRACT



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PLANNING LEVEL C
NEW CONSTRUCTION WITH CHARTER/CONTRACT
COSTS IN 1990 DOLLARS (MILLIONS)

ACTIVITY	FY1993	FY94	FY95	FY96	FY97	FY98	FY99	FY2000	FY01	FY02	FY03	FY04	FY05	FY06	FY07	TOTALS
Service life extension	25.0	18.0	17.0	16.0	0.0	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	81.0
Conversions	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Replacement vessels	32.0	15.0	23.0	68.0	29.0	0.0	66.0	52.0	23.0	23.0	96.0	83.0	41.0	70.0	0.0	621.0
New requirements	53.0	0.0	63.0	23.0	9.0	54.0	32.0	0.0	67.0	42.0	0.0	0.0	28.0	0.0	0.0	371.0
New operating costs	−2.0	9.5	9.5	11.5	11.0	13.0	16.5	19.5	25.5	27.5	24.5	25.0	25.0	25.0	25.0	266.0
Charter/purchase	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	330.0
Project costs	1.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	1.5	0.5	27.0
Commissioning/ changing orders	0.0	0.0	10.2	10.2	10.3	10.9	10.1	11.3	11.8	11.8	11.2	10.8	10.7	11.5	10.0	140.8
TOTAL	**131.0**	**66.5**	**146.7**	**152.7**	**83.3**	**106.9**	**148.6**	**106.8**	**151.3**	**128.3**	**155.7**	**142.8**	**128.7**	**130.0**	**57.5**	**1836.8**

GRAND TOTAL $1836.8

Cost Summary

Costs are summarized for each replacement option at the four levels. Many other options are possible.

Optimum scheduling of ship replacements, service–life extensions, and chartering vary with each option. This variance affects the total cost.

Costs are intended as relative indicators. Further analysis and refinement will be necessary to develop absolute program costs.

A 30–year cost summary should be developed for all models to reflect the total life–cycle costs.

A 30–year cost and comparison of the Planning Level A new construction versus chartering is included.

15–Year Summary of All Strategies

REPLACEMENT OPTIONS

	NUMBER OF SHIPS	DAS	AVERAGE* COST/YEAR $M	TOTAL COST $M
CURRENT				
Construct 6, SLE** 12	18	4,320	--	332
Construct all	18	4,320	49	736
Charter all	18	4,320	60	896
PLANNING LEVEL A				
Construct all	25	6,100	76	1,142
Construct 23, charter 2	23/2	6,100	74	1,104
Charter all	25	6,100	98	1,465
300 DAS, construct all	23	6,100	70	1,048
300 DAS, charter 2	21/2	6,100	72	1,077
PLANNING LEVEL B				
Construct all	33	7,910	100	1,500
Construct 26, charter 7	26/7	7,910	97	1,455
300 DAS, construct all	31	7,910	94	1,406
300 DAS, charter 7	24/7	7,910	95	1,426
PLANNING LEVEL C				
Construct all	43	10,215	128	1,918
Construct 36, charter 7	36/7	10,215	123	1,837

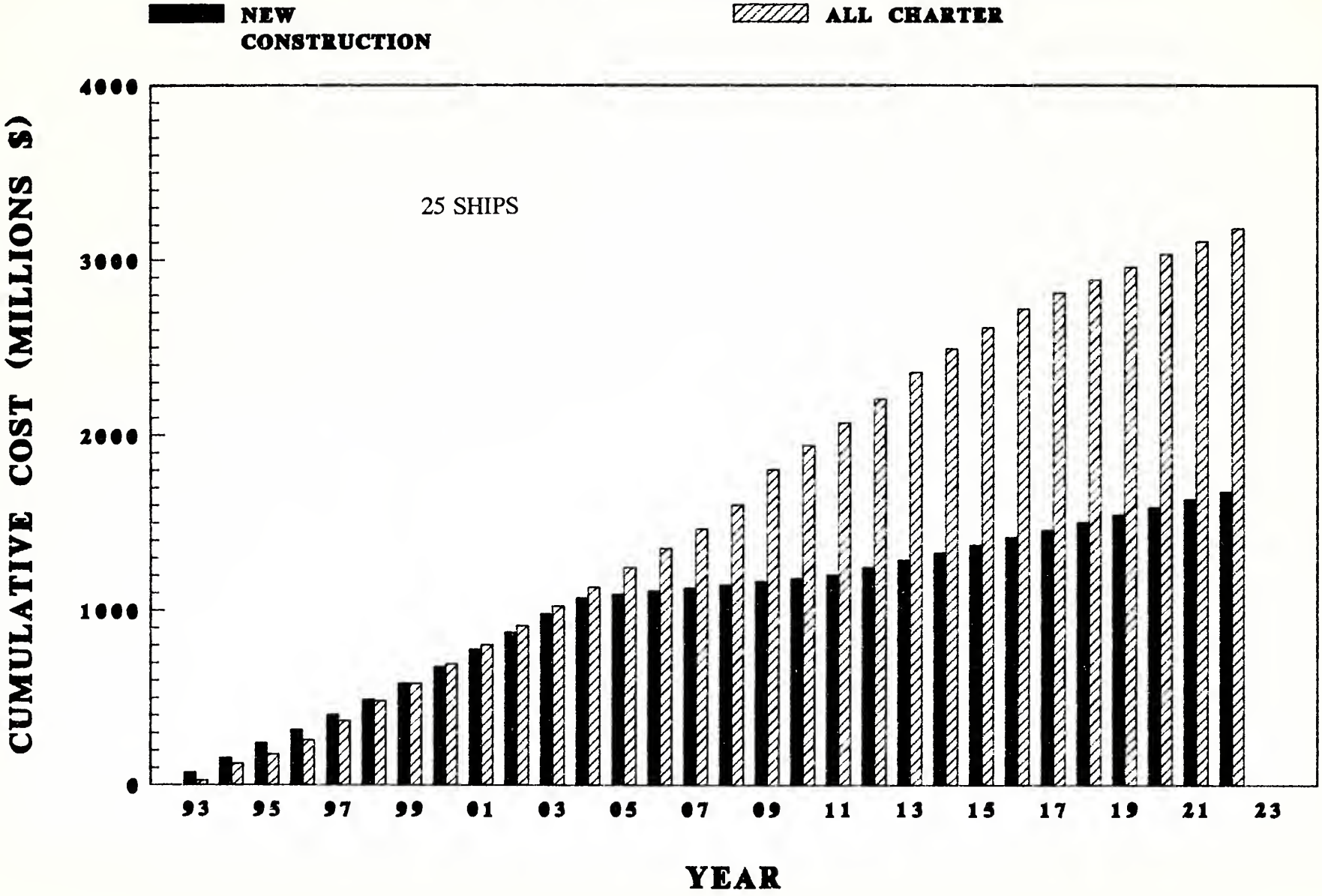
* Based on 15 years
** SLE is service–life extension

30–Year Comparison for Planning Level A New Construction and Charter

PLANNING LEVEL A
30–YEAR COST SUMMARY

	FY 1993 – FY 2007	FY 2008 – 2022	30–YEAR TOTAL
New Construction	1,142.5	578.9	1,721.4
Charter 25 ships	1,465.1	1,466.1	2,931.2

FLEET REPLACEMENT – PLANNING LEVEL A
30 YEAR CUMULATIVE COSTS



Appendix B

Programmatic Mission Requirements

Mapping and Charting

Mapping and charting requirements can be divided into two broad missions that require ship support from the NOAA fleet. The first mission is to collect data to maintain the organization's suite of nearly 1,000 nautical charts that are required for safe marine navigation. With one glaring exception, most of the inshore portion (i.e., inside the 150-meter curve) has been "surveyed" at least once. Vast tracts of Alaskan waters around the Aleutian Islands and the Bering Sea have never been surveyed. In addition, some of the areas which have been "surveyed" were done with technologies (lead line, dead reckoning, etc.) that do not meet modern standards.

Today's inshore requirements range from surveying frontier areas such as Alaska to maintenance of data sets where significant changes in the bottom configuration have resulted from natural and human-induced events (i.e., storms, earthquake slumps, submarine dredging, construction, etc.). In addition, the maintenance effort can include data-set upgrades where the original work was not detailed enough or does not meet modern International Hydrographic Organization (IHO) standards. These types of upgrade requirements occur when an area experiences major growth in large commercial vessel traffic, and vessel operators push the accuracy limits of the sounding and navigation data leaving little margin for error between the draft of the ship and the ocean bottom. Request for upgrades of these survey data are received on a continuous basis from federal, state, and local governments; commercial ocean operators; and recreational boaters.

NOAA employs a Survey Users Request File (SURF) to catalog and rank customer requests to help determine survey priority for chart maintenance. New user requests for surveys have averaged 100 per year over the last ten years. These requests identify approximately ten critical areas per year as being in need of varying degrees of survey work. Requests generally note a suspected or known deficiency on a NOAA chart that can require anywhere from a few days to several years of ship time to correct. NOAA also receives or generates, based upon customer reports, thousands of Notice to Mariners items annually, each denoting a deficiency or change in information depicted on the latest edition of NOAA'S nautical charts. An estimated 500 of these notices each year require ship investigations.

A second mission is to collect data outside the 150-meter curve within the Nation's recently expanded Exclusive Economic Zone (EEZ). The offshore mission is different from the inshore mission in that NOAA does not anticipate the need to resurvey or do maintenance in the area outside the 150-meter curve. Recent technological advances in the ability to sound with multibeam equipment, to accurately determine position with space-based navigation such as the Global Positioning System (GPS), and to acquire commercially available precise navigational

systems now make it possible to survey offshore to IHO standards. Data thus collected are used not only to upgrade offshore portions of NOAA's navigation charts but also to compile a suite of bathymetric maps and other digital data products. The agency has divided the offshore mapping mission into five sub–missions (East Coast > 1,000 meters, East Coast < 1,000 meters, West Coast > 1,000 meters, West Coast < 1,000 meters, and Far Pacific) to better accommodate geographic and ship–endurance considerations.

For the offshore areas, NOAA is in the process of building a SURF for incoming requests similar to that used with the inshore mission. Priority to date has been driven largely by NOAA partnership with the USGS to map the EEZ. Recent declassification of NOAA's survey data has resulted in renewed interest from a myriad of federal, state, university, private, and other NOAA program areas.

Living Marine Resources

The mission of NOAA relative to living marine resources (LMR) is to achieve continued optimum utilization of marine resources and protection of endangered species for the benefit of the Nation. A critical objective is maintaining the productive potential of these resources through management of fishing and other human activities which affect biological productivity. This requires an understanding of the dynamic properties of the marine ecosystems supporting the LMR as well as human effects on them. This understanding can only be achieved through a broad array of physical and biological studies which require research vessel support. These studies focus on assessing and predicting changes in the abundance and structure of LMR and associated biological communities with which they interact, investigating ecological processes controlling production potential of LMR, and documenting the range of natural variability observed in the marine ecosystem.

Some of the most important federal statutes relative to vessel needs for fisheries research include the Magnuson Fishery Conservation and Management Act, the Endangered Species Act, the Anadromous Fisheries Conservation Act, the Marine Mammal Protection Act, and the Driftnet Act. In addition, the U.S. is a party to many international agreements governing LMR's both within and outside the EEZ. These and other statutes mandate the collection of a wide array of information on LMR's and their environment from estuaries to the open oceans. A fleet of modern research vessels is needed to assess marine resources and their environment and meet all the demands for information on LMR stock assessments by Fishery Management Councils, develop a fundamental understanding of the ecosystems supporting LMR's, and respond to new mandates, e.g., marine mammal/fishery interactions. Limited amounts of these NOAA functions are currently performed on foreign research vessels or vessel charters, but the backbone of our future fisheries science will continue to depend upon NOAA research vessels. Major new programs with important ecosystem elements (Global Climate Change, Coastal Ocean Program) will require both qualitative and quantitative increases in vessel support, as well as more multidisciplinary and collaborative effort among NOAA line organizations, universities, and other marine research institutions.

Currently, NOAA provides the principal scientific information which supports implementation of 31 operational fishery management plans (FMP's) and 6 operational preliminary fisheries management plans. Three additional cooperative (with states)

FMP's are also supported by NOAA–provided scientific information. There are 5 additional plans pending with an additional 5 plans expected by the year 2000.

Only a few of the management plans in effect are based upon adequate scientific information. Increases in ship support are needed to provide more credible information on most current plans and for the additional plans contemplated. The most significant increases in NOAA ship–time requirements in the next decade are expected to be in ecosystem studies and protected species research.

Oceanography

Oceanographic research within NOAA will progressively emphasize long–term monitoring in order to better understand processes affecting the environment. Phenomena on almost all space scales, from the smallest to global, will be emphasized in these efforts. This will place extreme demands on sampling abilities, the need for rapid transfer of data, and the ability to synthesize the various data sets in close–to–real–time. It is clear that various classes of oceanographic and meteorological models will play a central role in synthesizing this information. It is also evident that remote sensing is essential to providing high–resolution data on global scales. Despite the rising importance of the use of numerical models and remote sensing, shipboard sampling will continue to play a vital role. Indeed, the need for complementary shipborne measurements will increase as the total research effort increases in both volume and diversity. At the same time, nontraditional methodologies not directly based on board ship will place significant new demands on the ship and its equipment, e.g., in instrument deployment and *in situ* calibration procedures for satellites.

Climate and Global Change

Developing an understanding of and the ability to predict global environmental changes, and particularly, global climate change, has been one of the major forces driving interest in ocean programs over the last several years. The role of the ocean in climate change is recognized as one of the central uncertainties in our ability to project future climate change and is thus one of the highest priorities in both the NOAA Climate and Global Change Program and the U.S. Global Change Research Plan. Understanding and forecasting climatic change requires an understanding of the processes of heat, moisture, CO_2, and momentum exchange between the ocean and atmosphere as well as the large–scale transports of heat within the atmosphere and ocean.

Activities are currently concentrated on problems associated with two different time scales of climate variations. The shorter of these is the interannual time scale. The best recognized example is the El Niño/Southern Oscillation phenomenon which is most clearly manifested in the tropical Pacific Ocean, but also has global implications. Accordingly, NOAA is a major participant in the Equatorial Pacific Ocean Climate Studies (EPOCS) and Tropical Ocean and Global Atmosphere (TOGA) programs in the tropical Pacific. NOAA activities in these programs are closely integrated between the Atlantic Oceanographic and Meteorological Laboratory (AOML), the Pacific Marine Environmental Laboratory (PMEL), and the Geophysical Fluid Dynamics Laboratory (GFDL) within the Office of Oceanic and Atmospheric Research (OAR); the National Weather Service (NWS); National Marine Fisheries Service (NMFS); National Ocean Service (NOS); and scientists in universities and in several foreign countries.

On longer time scales, the ocean circulation of heat from low latitudes to high latitudes is

believed to be one of the critical processes governing the climate of the earth and its variations. Most evidence indicates that the Atlantic Ocean is particularly important in this process. Therefore, NOAA is leading a program named Subtropical Atlantic Climate Studies (STACS) to learn more about the process.

The Global Climate Change/Radiatively Important Trace Species (RITS) program within NOAA concerns sources, transport and distribution, transformation, and removal of radiatively important atmospheric trace species in oceanic areas. The primary species being studied are ozone (O_3) and aerosols; among the related substances being studied are methane (CH_4), carbon monoxide (CO), low-molecular-weight non-methane hydrocarbons (NMHC's), and nitrogen species, iodine species, and sulfur. The program involves inorganic and organic chemistry, low-trophic-level (primarily marine) biology, meteorology, and physical oceanography, and has as its goal the generation of descriptive data on the distribution of important atmospheric trace species and quantitative understanding of geosphere-biosphere interactions. These programs require sampling large areas of the world's oceans.

Seafloor Processes. Recent studies suggest that seafloor volcanism and venting influence the chemistry and circulation of the oceans and, in turn, global climate. The magnitude of the impact is as yet poorly understood. For the next several years, there will be a critical requirement for ship-based reconnaissance and detailed surveys to statistically characterize the global hydrothermal environment, e.g., the extent and magnitude of active venting. Long-term monitoring is now beginning to become a reality as prototype seafloor instrumentation is being deployed by NOAA. As a consequence, the ship support will grow in relative importance during the coming decade. Another critical aspect of the need for a modern fleet in support of long-term monitoring will be the ability to respond to detected events. A major discovery of NOAA's VENTS Program has been the documentation of the occurrence of large-scale hydrothermal bursts. The major bursts (termed megaplumes) observed thus far each contained the mass and heat equivalent of the entire year's output of the essentially steady-state hydrothermal processes occurring along the ridge segment where the bursts originated. Megaplumes may be an important aspect of the global perspective of hydrothermal venting, but they occur episodically, as does seafloor volcanism, and long-term monitoring is being implemented to detect and locate these events in real-time. One of the anticipated highlights of NOAA's hydrothermal research in the coming years will be the ability not only to detect, locate, and remotely characterize episodic events, but also to respond with appropriate shipboard and ship-deployed instrumentation to quantitatively document, for the first time, the nature and evolution of such events and their effects on the ocean.

To achieve NOAA's climate and global change goals there is no substitute for actual ship observations. Accurate time-series records have several functions in the global change research program. These warn of natural and man-induced changes, signal the existence of previously unexpected phenomena, and provide observational tests of the ability of models to explain the global system. Without such an approach prediction will not be possible.

Coastal Ocean Program

The coastal ocean from a depth of 100 meters on the continental shelves and all shallower depths to the heads of estuaries contains the vast majority of the valued commercial,

recreational, and aesthetic resources of the sea. NOAA's coastal ocean programs are designed to make effective environmental decision–making possible by supplementing current retrospective analyses with timely forecasts and predictions. The ability to predict environmental change will allow us to prevent problems and exploit opportunities through proactive regional approaches, rather than only monitor and react to runaway problems. Providing decision–makers with useful predictions of environmental change––change caused naturally, as well as by society––is the goal of these programs.

Marine Environmental Quality. Marine environmental quality research emphasizes understanding of the complex physical and geochemical processes that ultimately determine the health of marine systems and their ability to assimilate contaminants. This research is part of continuing studies of estuarine and coastal environments. The objectives are to determine the residence times, budgets, and ultimate fates of selected chemical tracers in large estuaries, and to correlate these processes with physical forcing and chemical transformations. Included are studies of the geochemistry of trace metals and organic compounds, distribution of hydrocarbons and synthetic organics, coastal and estuarine circulation and transport processes. Although the geographic focus of these studies has been Pacific northwest and Alaskan coastal and estuarine waters, the scientific knowledge acquired and methodologies developed are applicable to other marine systems.

Fisheries Oceanography Coordinated Investigations. The Fisheries Oceanography Coordinated Investigations (FOCI) involves NOAA scientists in OAR, NMFS, and major universities. The FOCI program has introduced a multidisciplinary approach to understanding processes controlling variability of recruitment of commercially valuable fish and shellfish stocks. To date the program has focused on an important fishery for walleye pollock in the Gulf of Alaska and the Bering Sea, and on developing the most effective interdisciplinary research activities. The results obtained by this successful pilot program lead toward prediction of the variability of populations of commercially harvested marine species, and to plans for applying this coordinated approach to other fisheries. This ability to understand the processes involved in the variability of recruitment is essential both for managing our fisheries efficiently and for distinguishing natural variability from anthropogenic effects.

Sea Ice Processes. The objectives of sea ice research are improved ice forecasting, particularly for Alaskan waters; improved understanding and modeling of ice formation and movement; and the circulation of the shelf waters and the role of these waters in biological productivity and climate change processes. Improved ability to forecast superstructure icing also resulted from earlier work in the program. This research involves scientists from NOAA, major universities, and from the U.S.S.R.

This research has developed improved models for ice forecasting, which are now used operationally at the NOAA–Navy Joint Ice Forecast Center. Continuing research to improve forecasting involves the introduction of expanded model capability based on improved understanding of the physical processes, and evaluation of the effects of different boundary conditions and various model parameters.

A bilateral agreement with the U.S.S.R. has led to joint U.S.–U.S.S.R. research in the circulation of the Chukchi Sea and the exchange of waters between the Pacific and Arctic Oceans, and the role of these processes

in biological productivity on the shelf of western and northwestern Alaska. This is among the most productive areas of the world's oceans. It is known that the circulation on the western side of the U.S.–U.S.S.R. Convention Line differs significantly from the eastern side, and these U.S.–U.S.S.R. efforts will provide the first coordinated measurements. Long-term objectives are to understand the role of these waters in climate change processes, to understand how the shelf circulation determines aspects of the regional climatology and ice cover (important to navigation and other activities in the area), and development of a new generation of models for shelf circulation and sea ice.

Applied Oceanography

National Status and Trends Program. The National Status and Trends Program (NS&T) assesses the effects of human activities on the environmental quality in coastal and estuarine areas. Concentrations of toxic chemicals and trace elements in bottom-feeding fish, shellfish, and sediments are monitored annually from samples collected at a network of 200 sampling sites. As the Nation's longest, continuously operating monitoring program, the NS&T effort is the first to use uniform techniques and standards to measure coastal and estuarine environmental quality on a nationwide basis.

Circulation Studies. For over a century, safe marine navigation and maritime commerce have been enhanced by the provision of accurate and timely tide and tidal current predictions for the coastal waters of the United States. The coastal ocean circulation studies provide the regular deployment and recovery of instrumentation arrays to obtain a comprehensive suite of physical oceanographic data to update tide and circulatory information at major U.S. ports, harbors, bays, and estuaries.

OCSEAP. The Outer Continental Shelf Environmental Assessment Program (OCSEAP) conducts environmental assessment studies on the Alaskan continental shelf. This assessment is directed toward those areas identified by the Department of Interior as potential sites for oil and gas development. The program provides information on the potential effects of the outer-continental-shelf (OCS) development on living marine resources.

Appendix C

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